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Global biodiversity

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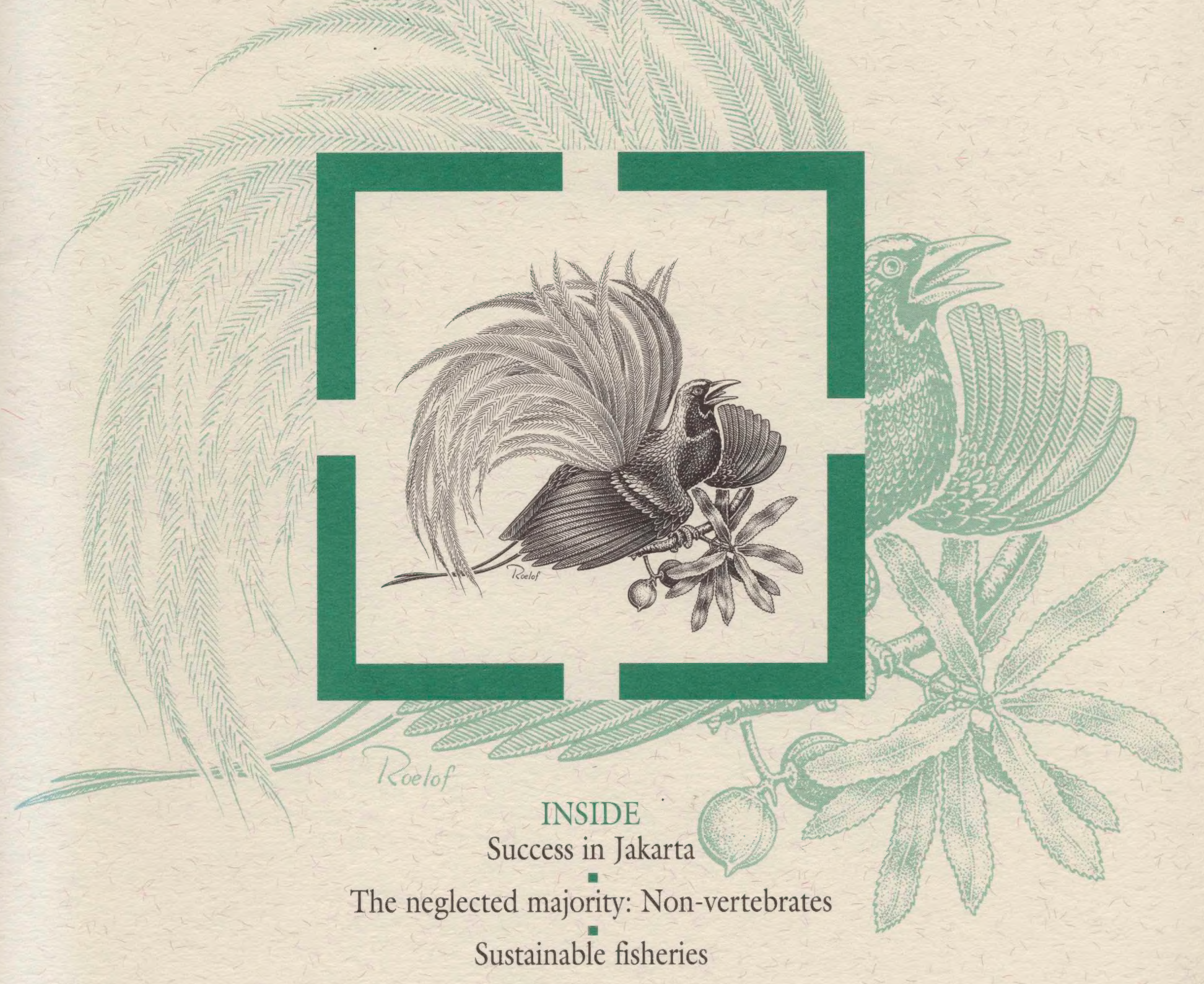

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Editor's Notebook

MORE THAN HALF OF THE EARTH—ITS HABITATS, SPECIES, AND GENES—IS UNPROTECTED!

Half of the planet Earth is without a single park or reserve. This unprotected area—which covers most of the globe's marine realm—includes the world's longest mountain range, the outer half of the continental shelves, the deeper ocean basins, and the deepest spot in the ocean. It comprises a living space or volume that is almost 100 times larger than that for terrestrial ecosystems. It is a living space that holds a rich variety of sea life, including flying fishes, giant squids, luminous jellyfishes, polar bears, and bacteria able to tolerate temperatures of 100 °C.

Seventy-one percent of the planet is composed of coastal or marine waters; 65% of Earth is in the deep sea beyond the continental shelves. Yet most parks and nature reserves are terrestrial. There *are* a number of protected marine areas, but almost all are in shallow waters next to land. This leaves the outer continental shelves with very few protected areas, and the continental slopes and the abyss with no protected areas whatsoever.

This is astonishing. Most of the greater branches (such as phyla) are uniquely or dominantly marine, even if most of the twigs (or species) are terrestrial. This gap leaves numerous marine ecosystems and species completely unrepresented. The offshore surface of the ocean, with its critical neuston layer used by thousands of species in their larval stages, is not represented. Neither are the vast mid-waters with their hosts of luminous species represented nor the sea-floor ecosystems, including sea monts and hot hydrothermal vents. Contrary to common perception, the diversity of species *increases* with depth down to 500 m or even as far as 3,000 m. Indeed, Grassle *et al.* have suggested that the number of deep-sea species could be as high as 10 million. Clearly, to fully conserve marine biodiversity, protected areas for the offshore shelves, slopes, and deep sea areas are needed.

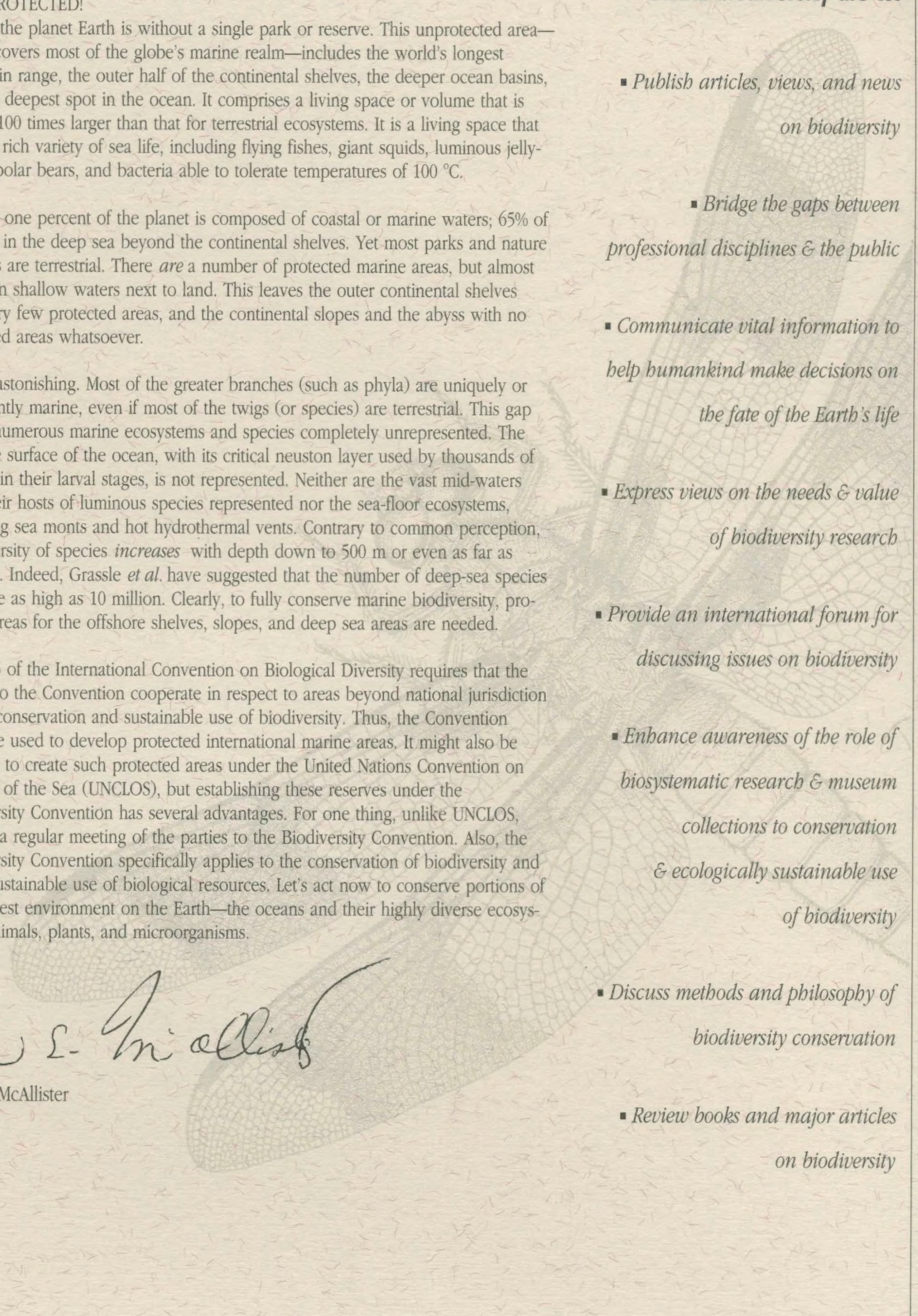
Article 5 of the International Convention on Biological Diversity requires that the parties to the Convention cooperate in respect to areas beyond national jurisdiction for the conservation and sustainable use of biodiversity. Thus, the Convention could be used to develop protected international marine areas. It might also be possible to create such protected areas under the United Nations Convention on the Law of the Sea (UNCLOS), but establishing these reserves under the Biodiversity Convention has several advantages. For one thing, unlike UNCLOS, there is a regular meeting of the parties to the Biodiversity Convention. Also, the Biodiversity Convention specifically applies to the conservation of biodiversity and to the sustainable use of biological resources. Let's act now to conserve portions of the biggest environment on the Earth—the oceans and their highly diverse ecosystems, animals, plants, and microorganisms.

Don E. McAllister

Don E. McAllister
Editor

The goals of Global biodiversity are to:

- *Publish articles, views, and news on biodiversity*
- *Bridge the gaps between professional disciplines & the public*
- *Communicate vital information to help humankind make decisions on the fate of the Earth's life*
- *Express views on the needs & value of biodiversity research*
- *Provide an international forum for discussing issues on biodiversity*
- *Enhance awareness of the role of biosystematic research & museum collections to conservation & ecologically sustainable use of biodiversity*
- *Discuss methods and philosophy of biodiversity conservation*
- *Review books and major articles on biodiversity*



Global biodiversity

Volume 5, Number 3, Winter 1995

The cover art shows the Bird of Paradise (*Paradisaea minor*), unofficial national bird of Indonesia, the site of the second meeting of the Conference of the Parties to the Convention on Biological Diversity.

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Success in Jakarta: A Canadian Perspective

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Canadians attending the second Conference of the Parties to the United Nations Convention on Biological Diversity (COP-2), held in Jakarta in early November, came away feeling satisfied and encouraged. The expression of confidence in Canada, demonstrated by the Parties through their selection of Montreal as home for the Convention Secretariat, was very gratifying to all those who had worked so hard on the Montreal bid. It was also gratifying to see substantive advances on important issues of Convention implementation; the success of the Canadian-organized Biodiversity Technology Fair, this time financially assisted by Australia; and the advancement of prospects for the effective participation of indigenous peoples of the world in COP-3, scheduled for Buenos Aires from 4-15 November 1996.

Equally encouraging was the change in atmosphere and the continued improvement in the collegiality among participants, under the guiding hand of Canadian Avrim Lazar, Chair of the Committee of the Whole. A number of participants later referred to the "Spirit of Jakarta," which reflected the warmth, openness, and cooperativeness of the people of Indonesia in the work of the COP. During group discussions of conservation issues, for instance, Parties were sharing experiences productively rather than negotiating political objectives in an atmosphere of mistrust. This bodes well for COP-3, and we should build on and nurture this spirit of cooperation.

FACILITATING TECHNICAL AND SCIENTIFIC COOPERATION

Among the major achievements of COP-2 was the decision on how to create a Clearing House Mechanism to promote and facilitate technical and scientific cooperation. This has the potential to be one of the most significant means of informing the Parties about the availability of technical help to address identified problems. The COP wisely decided to make this a user needs-driven mechanism that will rely heavily on the efficiency and accessibility of the global electronic information highway. The focal point of the mechanism will be the Secretariat, acting under the instruction of the COP.

LIVING MODIFIED ORGANISMS (LMOS)

The long awaited and much debated decision on the need for a protocol under the Convention for the safe transfer, handling, and use of LMOs was made at COP-2. This will focus on the transboundary movement of LMOs and will place emphasis on the key aspect of prior informed consent. The process to develop the protocol will begin immediately with the establishment of an ad hoc working group, reporting to the COP and carrying out its work intersessionally. The group will be open-ended, meaning that any Party wishing to participate can do so.

BIODIVERSITY CONSERVATION

In the area of biodiversity conservation, the Parties decided to send early signals of the seriousness with which they intend to treat conservation, particularly in respect to the resource management sector. Although the prime conservation focus for COP-2 was coastal and marine biodiversity, forest ecosystems and agricultural biodiversity received their share of attention.

In Forests

With respect to forests, the COP acknowledged the work of the Intergovernmental Panel on Forests (IPF) set up by the U.N. Commission for Sustainable Development. In so doing, it agreed to forward advice on forest management in relation to indigenous peoples, as had been previously requested. It also decided to send immediately some initial thoughts on forest biodiversity to the IPF, as well as to seek further views from the Parties for consideration at COP-3.

In Agriculture

Similarly, for agricultural biodiversity, the COP acknowledged the preeminent role of the FAO Commission on Plant Genetic Resources for food and agriculture and decided to send it some background thoughts to factor into its deliberations. Since agricultural biodiversity is a major topic for COP-3, further exchange is anticipated. For both forests and agriculture, COP-2 invited these two intergovernmental bodies, the IPF and the FAO Commission, to indicate to COP-3 their progress on their respective areas, so there could be interaction in both directions.

The breadth of scope of the Convention makes this type of relationship important. The Biodiversity Convention deals with biodiversity everywhere and, while COP does not want to duplicate or interfere with the work of sector-specific bodies, it does want to influence them. The countries making up the COP are, by and large, the same countries making up the other intergovernmental bodies dealing with the sectoral issues. The COP is keen, therefore, to promote cooperation among international bodies with somewhat different but compatible objectives.

In Coastal and Marine Areas

The coastal and marine discussions took a similar tack, but with somewhat more vigour. Again, a statement setting out COP's view of coastal and marine biodiversity issues was prepared, based upon work previously done by COP's Subsidiary Body for Scientific, Technical, and Technological Advice (SBSTTA). (For details on this work, see page 19 of this issue.) Pending the development of further work by the COP, this advice will be made available to the Parties and any relevant international body. In fact, the COP has listed over a dozen relevant bodies to whom the advice will be directed. Over the next few years the Secretariat will prepare material based upon periodic meeting of experts from all regions, inputs from Parties, and reviews by SBSTTA.

PROGRESS TOWARD FUTURE DISCUSSIONS

COP-2 initiated progress on a number of other matters on its agenda, which will bear fruit for discussion in later years. Studies will be undertaken on the relationship between intellectual property rights and the objectives of the Convention; on opportunities for and obstacles to the transfer of technology; on options for developing national legislative or other measures relating to access to genetic resources; and the identification, from a national perspective, of components of biodiversity particularly under threat. This latter item is intended to be a component of the first national reporting under the Convention, now scheduled for 1997 at COP-4. It was decided that the conservation focus for COP-4 would be inland water ecosystems where, in many countries, biodiversity loss is said to be occurring at an alarming rate.

All in all, it was a very productive meeting. The fact that it was still not able to reach consensus on the permanent operator of the financial mechanism nor the outstanding rules of procedure for voting on financial matters is unfortunate, but should not seriously affect Convention implementation in the short term.

PARTICIPATION OF INDIGENOUS PEOPLES

Many of us, who want to facilitate the advancement of the interests of indigenous peoples in COP acitivities, are anxious to see how the discussion unfolds at COP-3. Prospects for a substantive and enlightening session at COP-3, which will include the interests of indigneous peoples in a concrete way, improved at COP-2. At Canada's request, it was decided to create a position in the Secretariat to facilitate communication among indigenous peoples of all regions of the world as they prepare for COP-3. The government of Australia has agreed to finance the initial year of the position.

(Continued on page 47)

The neglected majority continues to struggle for recognition

Conservation efforts often neglect small species, including those not obviously useful and those from habitats unattractive to humans. Similarly species not closely related to humans are ignored, while the higher vertebrates, such as birds and mammals, are given high priority. To understand, appreciate, and conserve all of our fellow beings, no matter how small, useful, or related, is a major step forward, one that the EPIC Program took in 1994. As Dr. Aniskowicz, former director of Biodiversity Conservation for the Canadian Nature Federation, points out, only with increased awareness will we begin to understand that the small creatures and lesser plants play a critical role in the web of life. In fact, their role is often times more important than that of the larger creatures. Funding organizations should support conservation for non-vertebrates. [D.E.M.]

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INTRODUCTION

Approximately 95% of all species found in Canada are being overlooked by national conservation programs. Traditionally, large, colourful, or attractive species have benefited most from our philanthropic urges. Among these, the birds are the most fortunate, receiving more attention than any other group of organisms and having the greatest number of programs dedicated to their conservation. Because the majority of people are attracted to vertebrates, current conservation programs tend to focus on the more prominent species that account for less than 5% of all species found in Canada (Hyslop and Brunton, 1991). After all, who wants to save a disgustingly slimy slug or some unassuming lichen that grows high up in tree-tops where no one sees it anyway? Should we even be concerned about such organisms?

Both environmentalists and governments have come a long way toward understanding that *all* organisms are an integral part of ecosystems. However, they still have difficulties translating this theoretical understanding of the importance of the less prominent species into concrete actions.

WHAT COMPRISES THE MAJORITY?

The largely ignored majority consists of vascular and non-vascular plants, fungi, algae, lichens, and the incredibly numerous and diverse invertebrates. Although less conspicuous, these organisms are beautiful, useful to mankind, and absolutely essential to ecosystems. It is easy to stop and marvel at the beauty of a colourful butterfly or a showy flower. It takes a more conscious effort, however, to look closely enough at many other non-vertebrates to appreciate their intricate designs, textures, colour patterns, and the engineering that makes them so superbly adapted to the lives they lead. Witness the delicate but incredibly strong, translucent housefly wing with opaline hues or the marvelous geometric structure of diatoms seen through a microscope!

ARE THE NON-VERTEBRATES USEFUL?

Although people rarely think of it, non-vertebrates are indispensable to humans. All of our food, including animal protein, is derived directly or indirectly from plants. Algae are the source of agar used for bacterial cultures, a crucial step in some medical tests. Without pollinating insects, we would have few fruits and nuts and no honey. Bacteria give us yogurt, cheese, and sauerkraut while fungi (yeast) give us bread, beer, and wine. And where would we be without the lowly penicillium mold and all the other microbes that produce antibiotics?

Non-vertebrates are also essential to ecosystems. Indeed they constitute the vast majority of the biodiversity of planet Earth. They are responsible for vital ecological processes such as decay, nutrient cycling, nitrogen fixation, mycorrhizal associations, and pollination. In short, they form the broad base of the pyramid of life. If this footing were to crumble, the entire structure would tumble; in other words, without the largely neglected majority of non-vertebrates, the conspicuous 5% of species that receive most of the attention could not exist. Yet, remarkably, no national program focuses on this majority.

HOW IS THE MAJORITY BEING CONSERVED? THE EPIC PROGRAM

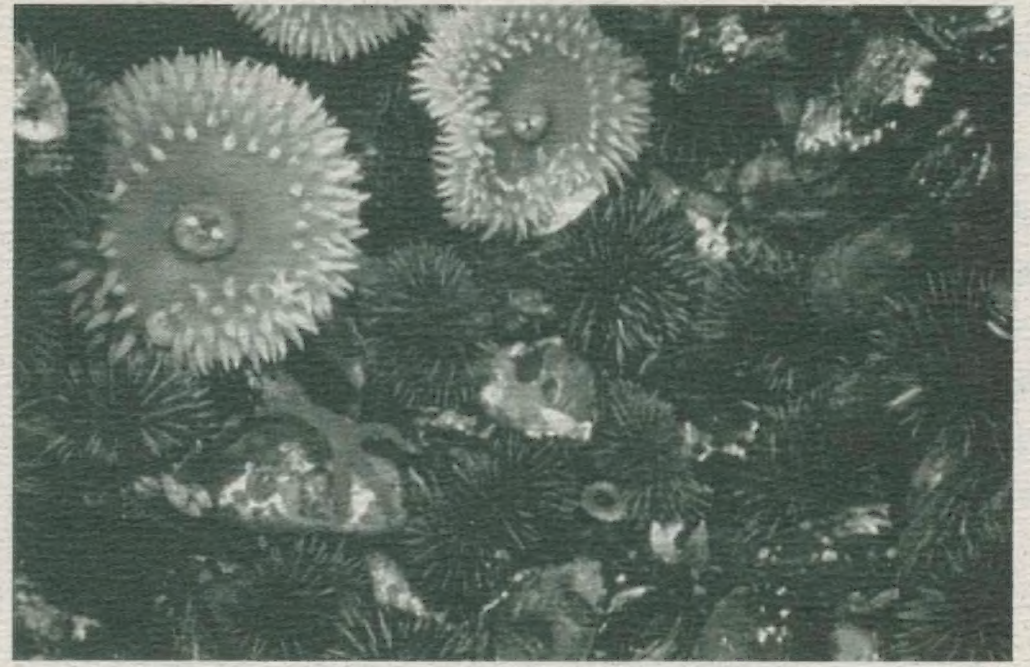
Finally the realization is dawning that all wild species must be conserved—if we are to maintain Canada's biodiversity. But what is being done, and how?

Canada has two national programs dedicated to dealing with species at risk. The Committee on the Status of Endangered Wildlife in Canada (COSEWIC) evaluates the status of species and places them on Canada's official list of endangered species (Heppes, 1993). Traditionally, it considered only terrestrial and aquatic vertebrates and vascular plants. The program called Recovery of Nationally Endangered Wildlife (RENEW) mounts recovery efforts only for the terrestrial vertebrates (mammals, birds, reptiles, and amphibians) listed by COSEWIC (Aniskowicz, 1991).

Even with these two programs in place, more than 95% of Canadian species are still being ignored at the national level. To address this major conservation gap, the Endangered Plants and Invertebrates in Canada (EPIC) program was initiated. With funding support from the Canadian Wildlife Service of Environment Canada and Noranda Inc., the director of Biodiversity Conservation for the Canadian Nature Federation (CNF) was responsible for conceiving and developing the program.

The development phase included extensive consultations with scientists in universities, museums, conservation data centres, and governments, and with wildlife managers and conservation organizations. The resulting program was to have four objectives:

- identify non-vertebrate species at risk
- protect these species and their habitats
- create a central database to assist in the two preceding tasks
- increase public awareness of the importance of non-vertebrates.



Without the largely neglected majority of non-vertebrates, the conspicuous 5% of species that receive most of the attention could not exist. (Photo by B.T. Aniskowicz)

YEAR ONE: IMPLEMENTATION

The implementation of EPIC was begun in the spring of 1994, and within the first year, significant progress was made in all four areas. Indeed, the multi-faceted, unique, and innovative program was recognized as a model initiative that broke new ground.

Efforts convinced COSEWIC to expand its mandate to include non-vascular plants and some invertebrates (mollusks, butterflies, and moths). Non-vascular plant taxa are being addressed by specialist groups set up within COSEWIC's plant subcommittee, and in April 1995, COSEWIC listed its first non-vascular plant, the cryptic paw lichen (*Nephroma occultum*) found in the old-growth forests of British Columbia as a Vulnerable species. (See the back cover for an illustration of this lichen.) This is a major step forward for the neglected majority.

In June 1994, the Chair of the new invertebrate subcommittee was appointed. Some initial work, including the assembly of expert members, has now been completed and two status reports have already been commissioned. A draft status report has been prepared on the Gatineau tadpole snail (*Physella parkeri latchfordi*), a freshwater mollusk believed to be endemic, or restricted, to Canada (Clarke, 1981), and another report is being prepared on the Karner blue butterfly (*Lycaedes melissa samuelis*). The subcommittee anticipates that the first invertebrates will be listed in 1997 and that COSEWIC will eventually expand its mandate incrementally to include other invertebrate groups.

Although COSEWIC's recognition of non-vertebrates is encouraging, it is evident that COSEWIC will be unable to deal with most species. While the species-by-species approach can be used to identify and mount recovery programs for a limited number of fairly well-known organisms, it cannot deal with the huge numbers of poorly studied non-vertebrate species that have yet to be classified, let alone protected, in order to truly conserve biodiversity in our vast country (McAllister, 1994).

Realizing that both increased knowledge and a community/habitat approach are needed to protect such species, part of EPIC's role was to initiate on-the-ground conservation projects (Aniskowicz, 1994). In 1994, EPIC helped fund two existing initiatives: the Karner Blue Butterfly Recovery Project and the Western Prairie Fringed Orchid Project. The ultimate objective of the former project is to re-establish the extirpated Karner blue butterfly in its native oak-savanna habitat in southern Ontario. Habitat restoration and a captive breeding program, essential steps to achieving this end, are in progress. At the same time, plant and insect inventories have been conducted, and the project includes the restoration of other rare components of the ecosystem.

It takes a more conscious effort to look closely enough at many non-vertebrates to appreciate their intricate designs, textures, colour patterns, and the engineering that makes them so superbly adapted to the lives they lead. (Photo by B.T. Aniskowicz)

Likewise, the Western Prairie Fringed Orchid Project seeks to protect and restore the habitat of this endangered species. By doing so, it hopes to ensure that the only Canadian population of this orchid can continue to survive in southern Manitoba. Some of this mixed-grass prairie and aspen parkland habitat has already been protected and managed for the orchids, and the development of a comprehensive recovery plan was funded by EPIC. Although targeting a specific species, this project has already begun addressing the rehabilitation of other rare species found in the orchid's habitat.

To give EPIC and all its projects a solid, scientific basis upon which decisions can be made, the program's principal objective was the compilation of a central computerized database. This database would assist in determining which species are at risk, facilitate access to scientific data that are currently scattered in notebooks, various collections, and small databases, identify knowledge gaps, and make complex analyses and comparisons possible. With support from Intera Information Technologies and Tydac (two mapping and software companies), the CNF acquired a geographic information system (GIS) for this purpose. After designing the database, EPIC began developing data-sharing agreements with institutions such as the National Atlas Information Service (NAIS). Even before completing a formal agreement, NAIS provided a digital base map of Canada.

The Canada-wide Lady Beetle Survey, another EPIC project, is intended to be conducted annually, similarly to the Breeding Bird Survey. It actively involves the public in collecting data for conservation purposes, including young people. To this end, Industry Canada generously made the survey available on its SchoolNet, which is accessed by over 5,500 schools (and all but one university) across Canada. By encouraging public involvement, the survey teaches participants about the importance of EPIC species, and over the long term, can gather important data too costly to obtain through scientific surveys. However, to be useful, data must be collected over many years. Otherwise, it will be impossible to separate natural short-term fluctuations and observer-induced variability from real changes. As the data is collected, the plan is to enter it into a dedicated database and map it to track changes in the distributions of lady beetle species, particularly the spread of introduced species and their effects on native beetles. Based on the results, appropriate conservation actions could then be initiated, if warranted.

YEAR TWO: EPIC FACES CUTBACKS

Although during the past year the CNF has been reviewing all of its programs and to date has not yet determined what its focus will be, it decided to cut costs in March 1995. Consequently, it laid off its entire conservation staff, including all conservation directors, and left only one person, previously committed to developing a new bird program, in charge of conservation. Moreover, at the COSEWIC annual meeting in April 1995, the executive director of the CNF stated that any EPIC projects would be done by contract—and only if specifically funded. It appears that once again the non-vertebrates will receive little attention.

The species-by-species approach cannot deal with the huge numbers of poorly studied non-vertebrate species that have not yet been classified. (Photo by B.T. Aniskowicz)

To date, the CNF is implementing only one aspect of the EPIC program, the Lady Beetle Survey, and said it would continue support for the Karner Blue Butterfly Recovery Project. Both projects are of interest to the CNF because they are catchy, high profile, and attract public attention and funding. While valuable in themselves, they are only a small portion of the greater goals of EPIC. They will help one insect species and one genus, but will do relatively little for non-vertebrates as a whole.

This past spring, the Lady Beetle Survey was launched through *Nature Canada* (MacRae, 1995), and is now available on the World Wide Web at **<http://schoolnet.carleton.ca/english/ladybug>**. Anyone interested in the survey can write to: Lady Beetle Survey, Canadian Nature Federation, 1 Nicholas Street, Suite 520, Ottawa, Ontario K1N 7B7, Canada. As of September, the response to the survey was reported as being very good, and the CNF is interested in repeating it. In the spring of 1996, an identification guide with a response form will be available by mail as well as on the World Wide Web. So far, however, there has been no commitment to continue the survey over the many years required for reliable detection of trends. Will it be continued once it loses its publicity value?

Also, toward the end of the 1994-95 fiscal year, EPIC raised some funds for the Karner blue butterfly. The CNF said that a portion of this money would be turned over to the group of scientists and naturalists who are working on the recovery of the butterfly, but this has not yet happened.

Although none of the other, more widely applicable scientific aspects of the EPIC program have moved forward so far this year, non-vertebrates at risk are being addressed independently of EPIC by the Plant and the Mollusk and Lepidoptera subcommittees of COSEWIC. Both subcommittees depend entirely on the volunteer work of the scientists who chair them.

PLEA FOR ACTION

This state of affairs is obviously inadequate, particularly for the non-vertebrates...so long overlooked. The proposed piecemeal approach for EPIC, with parts being done only *if* and *when* funds can be found will not give satisfactory results. With such an approach, who will ever champion the cause of the mycorrhiza hidden below the soil surface? Evidently, even conservation groups are still not prepared to implement a full-blown conservation program for *all* non-vertebrates.

Given the current situation, is there another organization or agency, or perhaps the federal government, that could take over the scientific aspects of non-vertebrate conservation? If Canada is truly committed to conserving its biodiversity (an obligation it undertook when it ratified the International Convention on Biological Diversity), it cannot afford to continue ignoring the vast majority of its species.

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Working towards sustainable fisheries – A consensus approach based on precise stock identification

In fisheries around the world, specifically in the ground fish and Pacific salmon fisheries of Canada, there is a growing awareness that new approaches are needed to manage these valuable renewable resources and to precisely identify and conserve priceless stocks. The Skeena River initiative brings together aboriginal peoples, commercial and recreational fishers, and provincial and federal governments into a co-management process. Co-management is not only capable of combining scientific and traditional ecological knowledge, but also creates a more unified social organization that is working towards common goals. Within such a group, there is much less waste of energy on "us" and "them" stances. This consensus approach can only benefit the biodiversity at stake. [D.E.M.]

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INTRODUCTION

In August 1993, the Skeena and Kitimat rivers in British Columbia (B.C.) became the focus of a $14-million, four-year model fisheries program—an initiative of the Canadian Department of Fisheries and Oceans of Canada (DFO).

The main goal of the Skeena-Kitimat Sustainable Fisheries Program is to develop and demonstrate the most effective ways to manage fisheries in order to ensure a healthy resource for the future, one that benefits all those who depend upon it for food and for their livelihood.

Fisheries management on the Skeena is a complex and sensitive issue. The river supports all species of Pacific salmon, but each species consists of many stocks (or populations). Weaker stocks migrate at the same time as more abundant ones and are caught in the same fisheries. The very real danger of overfishing these more vulnerable stocks is the subject of public concern and debate in B.C., particularly in the Skeena and Kitimat watersheds.

CONSENSUS APPROACH TAKEN

At the heart of the program is the Skeena Watershed Committee, a group that represents the people who have a stake in this watershed: aboriginal groups, commercial and recreational fishers, and the provincial and federal governments. The challenge of the committee has been to find ways to go beyond the animosity and distrust that has historically characterized relationships between the various concerned groups and government on the issues of fisheries management.

Since its formation several years ago, the committee has been active, and many tough decisions have been made by non-government members through a consensus approach. Because of the commitment of members to ensure trade-offs were made on all sides, an historic agreement for a three-year fishing plan was reached in 1994.

The work accomplished so far shows that conservation of the resource is a top priority for all committee members. As Brian Tobin, Minister of Fisheries and Oceans, stated: "People were willing to make changes and those who had not been able to work together found a way to do so."

IDENTIFYING SALMON THROUGH GENETIC MARKINGS

The program includes protecting the less productive steelhead trout and coho salmon stocks, while maintaining and enhancing the aboriginal and commercial fisheries of the more abundant sockeye and pink salmon stocks. By dedicating projects to increasing information about the various populations of each species, the information can then be used to support a more stock-specific style of fisheries management.

Identifying salmon through genetic markings is an important facet of building and increasing our knowledge base of the Skeena fisheries resource. Salmon from different regions often travel together for part of their return voyage to the spawning grounds. In the Skeena River system, this presents a massive challenge to those who manage what are called mixed-stock fisheries. The challenge is great because different stocks, or populations of one species, are genetically discrete, and as mentioned before, some stocks are more vulnerable to overfishing than others and must be protected.

To protect individual populations of salmon, fisheries managers have to be able to recognize them while they are en route to their spawning grounds. Armed with stock identification techniques, the less productive wild sockeye, coho, and steelhead populations in the Skeena River system will be managed more effectively.

A quick glimpse at just sockeye in the Skeena system shows the complexity of fisheries management. At least 57 distinct sockeye populations exist in lakes throughout the watershed. Of the three runs defined for management purposes—early, middle and late—the early run includes many of these populations, whereas the middle and largest run consists predominantly of sockeye from the Fulton River and Pinkut Creek, including those from enhancement facilities located on these systems.

Dr. Chris Wood, DFO research scientist at the Pacific Biological Station, is coordinating the genetic stock identification program for sockeye and coho populations in the Skeena River system. The Province of B.C.'s Ministry of Environment, Lands and Parks is undertaking similar research on steelhead.

When attempting to identify salmon populations, scientists look for what are called biological markers. Scale patterns, the prevalence of parasites, and the frequency of genes examined by protein electrophoresis or by DNA probes can all act as natural tags in populations. A number of techniques to find and use these markers have already been developed, particularly for sockeye. The effectiveness of these techniques is now being tested.

The Skeena River at dawn.

At the same time, another of the program goals is being worked on—the development of a genetic stock identification technique for coho. Less work has been done on coho, and according to Wood, genetic stock identification techniques may be more difficult to apply to this species than to steelhead and sockeye. This is partly because coho stray farther from their natal spawning site than sockeye, and consequently, their genes flow from one spawning area to another. The reason for this difference probably lies in the rearing habits of the two species. Because juvenile sockeye typically rear in lakes, adult sockeye must spawn in tributaries that provide their offspring access to a nursery lake. Coho do not rear in lakes, and therefore, it is not as critical that they spawn in the same spot each generation. To define populations for conservation and management we need to know how much the genes flow or spread. If the exchange of genes between spawning areas is small, the salmon in these areas are likely to have very different adaptations, which should be conserved.

STOCK IDENTIFICATION BY SCALE PATTERN

Scale patterns, one of the earliest biological markers used for stock identification, are especially useful for identifying sockeye. The scale rings record how fast the fish grow. The growth rate, in turn, depends on the temperature of the lake water and how much food is available. The amount of food depends on how many fish are "grazing in the pasture." If there are lots of fish, the food crop can be grazed down quite quickly. Sockeye from the same lake usually have similar scale patterns.

But there are drawbacks: "Scales are a cheap, relatively easy way to identify fish," says Dr. Wood. "They store well and you don't have to kill the fish to get samples. However, as biological markers, they are not stable from year to year because food abundance in the lakes can fluctuate from year to year. You can't know ahead of the season what the pattern will look like."

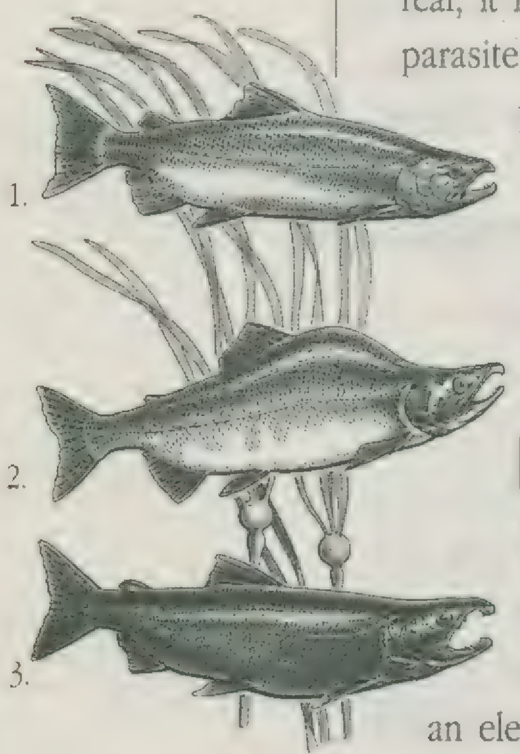
Also, identification through scale patterns is less suitable for chum and pink salmon that migrate directly to the ocean, and for coho or chinook that rear in rivers where the number of fish and the food supply varies among tributaries.

PARASITES AS MARKERS

How many types of parasites a fish carries depends on the species and the population. Often one species of parasite is common in one population and rare in another. Like scales, parasites are an ecological marker; what type the fish carries primarily depends on its rearing environment. Most fish carry parasites and most of these parasites pose no threat to humans.

In DFO's work with sockeye, two parasites are being examined. One is a microscopic single-celled animal that forms spores, which can be detected in the brain tissue. The other is a roundworm found in the body cavity of the salmon. The brain parasite is particularly useful, in a limited area, for determining whether a sockeye is from Alaska or Canada. Because the parasite is usually found in coastal lakes where most southeast Alaskan salmon rear, it is reasonable to assume that sockeye with the parasite come from Alaska while those without the parasite originate in Canada where sockeye rear in interior lakes. This thumbnail rule, cautions Wood, is not perfect and works fairly well in northern B.C. and southeast Alaska, but not elsewhere in the Pacific.

The salmon featured below are all "spawning males."



1. Chinook salmon (*Oncorhynchus tshawytsha*)
2. Pink salmon (*Oncorhynchus gorbuscha*)
3. Coho salmon (*Oncorhynchus kisutch*)

LOOKING AT GENES THROUGH PROTEIN ELECTROPHORESIS

Electrophoresis is a process in which particles (in this case, enzymes in tissue samples) with an electrical charge migrate in a solution under the influence of an electric current. The process works in this way: the sample is placed on a gel substance, something like a slab of jelly, and subjected to an electric current. The length of time and amount of current is strictly controlled. The proteins in these enzymes have electrical charges that move under the electric current. Some move faster than others and in specific directions. Eventually, when the current is turned off, strings or bands have formed on the gel, each band with specific characteristics or patterns.

"From this," says Wood, "we can infer genetic characteristics of individual fish. We want to determine the percentage of fish in each population that have specific genes. Unlike scales or parasites, we believe that these patterns of genes will remain constant from year to year. This is the chief advantage of genetic markers over ecological markers."

In science, looking at the same thing in different ways can lead to different results. This proved true for protein electrophoresis research in coho, but enzymes useful for sockeye did not prove useful for coho. If the right enzyme is found, however, researchers at the U.S. National Marine Fisheries Service in Washington State are finding that electrophoresis can be used to identify coho stocks. DFO scientists plan to examine the same enzymes in Skeena River coho in a joint study with the National Marine Fisheries Service.

PROBING THE DNA

Another technique—the so-called genetic fingerprinting—gives science a way to find many more genetic markers for identifying salmon populations. Coordinated by Drs. Ruth Withler and Terry Beacham, the salmon DNA research at DFO's Pacific Biological Station in Nanaimo, B.C. is among the most advanced in the world. Withler can directly examine the differences in DNA by probing DNA extracted from small samples of tissue or blood.

There are two basic kinds of DNA. The first comes from the nucleus of a cell and is called nuclear DNA; the second is found in the cell's mitochondria (which are the small, round, rodlike, or filementous structures in the cytoplasm of cells, transmitted in the eggs from mother to offspring) and is called mitochondrial DNA. They look quite different from one another. The mitochondrial DNA occurs as a single-stranded loop, whereas the nuclear DNA occurs as a double strand. By looking at the DNA, variations in the chemical sequence (the genetic code) within the strands of DNA can be seen. These variations are what make each fish unique.

Results to date show extensive genetic differences among populations of sockeye and steelhead in the Skeena River system. Future research will emphasize screening additional populations and developing and verifying cost-effective procedures for sustainable fisheries management in the Skeena watershed.

COHO HABITAT: HOW PRODUCTIVE IS IT?

In the head waters of the Skeena River there are mounting concerns about coho salmon. Northern interior coho are thought to be less productive than coastal coho, and recent declines in the abundance of all indicator stocks are serious.

Despite the historic use of the Skeena River salmon resource, there is little information available to assess species like coho. The few programs existing provide only part of the picture. Some of the basic biological characteristics of Skeena coho are unknown. Consequently, there is only a limited understanding of what the productive capabilities of the Skeena actually are for coho, and an even less complete picture of how those capabilities might be changing.

Dr. Blair Holtby, at DFO's Pacific Biological Station, specializes in studying escapement (those fish that managers let go uncaught to ensure the reproduction of the stock) and habitat interactions. He is working on projects that will change what we know about coho. Improving programs that provide statistics for catch distributions, ocean survival rates, and harvest rates over a period of time is one of the objectives of his work. He will also be studying the relationships between coho production and habitat to estimate the productive potential of the Skeena drainage. As part of the coho program, alternative assessment approaches will be developed that are better suited to coho in the Skeena.

"The Skeena is such a big and diverse place that it is inconceivable that detailed work will be possible on more than a small number of tributaries," says Holtby. "A reasonable approach might be to divide up the entire drainage into 'bio-geo-climatic' zones and then work intensively on a few systems within each zone. Some of what we are doing is laying the groundwork for just such a classification."

The idea, then, is to first identify a reasonable number of zones based on geology, chemistry, temperature, and the biota (animal and plant life). Within each zone, one or two streams would be selected where populations would be closely monitored and perhaps, manipulated.

An example of this methodology is taking shape in the Bulkley and Morice drainages. For the past eight years, in late summer, Holtby and his team have visited more than 30 sites in these two river valleys and sampled juvenile coho. These surveys confirm a serious conservation problem in this area. But, at the same time, the size and density information collected suggests that most sites in these rivers are potentially more productive than coastal streams. This is a surprise. According to Holtby, conventional wisdom dictates that interior sites should be less productive.

To explore this surprising revelation, Holtby has begun to collect basic habitat information for the area. This includes recording water temperatures at ten sites scattered throughout the Bulkley and Morice drainages. "To do that," says Holtby, "we are using miniature data loggers. These little marvels are the size of a match box, and will operate for two years recording temperature every 15 minutes. In addition, we have installed automated stations at three sites in the Morice to monitor dissolved oxygen in side-channels and ponds known to be important for over-wintering coho. At the sites where we are monitoring temperatures, we are also taking water samples during summer low flow and just after spring break-up. These are being analyzed for concentrations of major nutrients and dissolved solids by the lake enrichment lab at DFO's West Vancouver Laboratory."

All of this information will be used to compare this particular part of the Skeena with coastal systems in the north and south. Holtby is now planning a study site with fences so that coho adults and smelts can be counted, and the juvenile biology of this species can be studied. Over the next couple of years this approach will be extended to the entire Skeena drainage.

Here a scientist measures the length of a spawned salmon on the Babine River. About 90% of the Skeena River sockeye salmon spawn in this river and other tributaries to Babine Lake. Collecting data provides an accurate figure on salmon escapements, confirming the number of spawners getting to the spawning grounds.

CONCLUSION

Since 1993, the Skeena-Kitimat Sustainable Fisheries Program has been focusing on techniques and methods designed to enhance the sustainable use of the anadromous fish stocks found in these watersheds. Through consensus management, precise stock identification, and the study of biological support systems in the natal streams, much progress has been made. And there are still two years to go in the project!

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Ontario wetlands: An evaluation of adjacent lands

Landscape theory, explored by Aldo Leopold, teaches us that ecosystems are connected to one another through time and space. No ecosystem is isolated, no more than any man is an island. With all the emphasis on conserving and restoring wetlands it is therefore important to understand how wetlands are connected to adjoining ecosystems. This paper contributes to that understanding. [D.E.M.]

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INTRODUCTION

Wetlands, as defined in the Ontario Ministry of Natural Resources (OMNR) **Wetlands Policy Statement**, include "lands that are seasonally or permanently covered by shallow water, as well as lands where the water table is close to or at the surface" (OMNR, 1992). Wetlands are thus classified into four major groups: marshes, swamps, bogs, and fens (OMNR, 1992). Wetlands and their bordering regions provide important ecosystem functions, such as flood control, sediment trapping, ground water purification, and nutrient retention and removal. As well, wetlands provide essential habitats for many wildlife and plant species (OMNR, 1992; Wildlife Habitat Canada [W.H.C.], 1988; W.H.C., 1991).

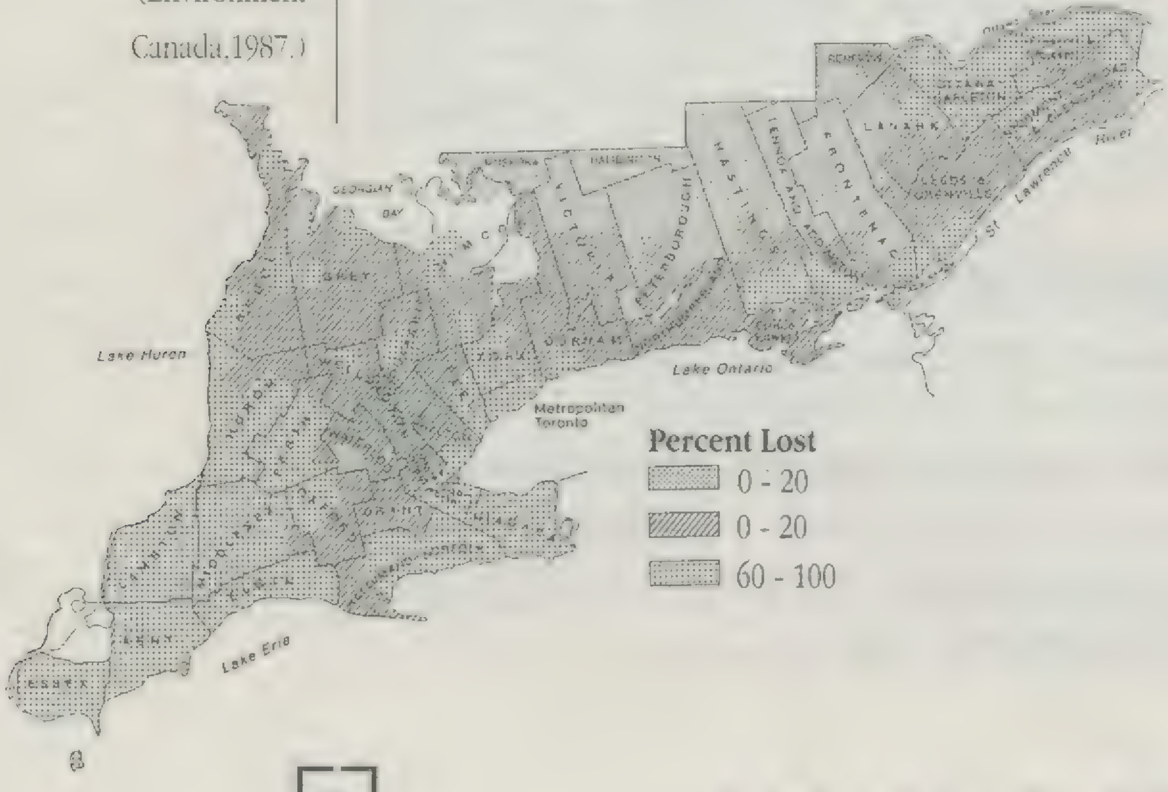

Figure 1. Wetland loss in southern Ontario. (Environment Canada,1987.)

Canada, which contains 25% of the world's wetlands, has suffered a substantial loss of wetlands since the settlement of Europeans. In fact, as shown in Figure 1, nearly three-quarters of the original wetlands in southern Ontario have already been lost (OMNR, 1992), mainly due to the vast conversion of wetlands into agricultural lands. According to the 1991 WHC guidelines, an incredible 85% of all wetlands lost in Canada were lost to agricultural drainage; 9% were lost to urban/industrial expansion; and 2% were lost to each of recreation development, hydro-electric development and lake level management, and forestry and peat harvesting.

As a result the OMNR, in association with Ministry of Municipal Affairs (MMA), has developed a policy statement in an attempt to prevent further wetland loss. The OMNR (1992) policy states that for the Great Lakes/St. Lawrence Region (the half of the province just south of Wawa, Chapleau, and Gogama):

1) There shall be no development within provincially significant wetlands.

2) Development on adjacent lands will be permitted only if:

- there is no loss of wetland function
- subsequent future development does not negatively affect wetland function
- development does not conflict with pre-established wetland management schemes.

"Adjacent lands" are "those lands within 120 metres of an individual Wetland area; and, all the lands connecting individual Wetland areas within a Wetland complex" (OMNR, 1992), as shown in Figure 2. The objective of this paper is to provide an evaluation of the above stated policy dealing with adjacent lands. Is the 120 m width given for adjacent lands valid? Our evaluation has been achieved through researching and examining the scientific data available on adjacent land use with respect to wildlife habitat and the control of nutrient runoff.

RESULTS AND DISCUSSION

Adjacent Land Use by Wildlife

As previously stated, one function of adjacent land is to maintain species diversity by providing quality habitat for a wide variety of animals (Deshmukh, 1986; Kusler et al., 1994; W.H.C., 1988). The uses of adjacent land by various wetland animals are shown in Table 1. The corresponding graph (Figure 3) illustrates that most of the animals in our study use lands that are within 110 m of the shoreline. In support of this, based on a similar study done by the United States Fish and Wildlife Service, Castelle et al. (1994) estimated that a width of 106 m surrounding a wetland was adequate to meet the needs of most wetland animals.

Adjacent Lands and Nutrient Runoff

In addition to maintaining species diversity, adjacent lands serve to protect aquatic ecosystems from the impact of humans, such as nutrient run-off. The negative impact from nutrient run-off include algae blooms, the loss of rare plant species, and reduction in wildlife diversity (Moore et al. 1989; Wisheu et al. 1991).

Castelle et al. (1994) suggested that to maintain the biological, chemical, and physical components of wetland ecosystems, a vegetated strip of land (a buffer, as he defines it) of 30 m is sufficient. However, in the same paper he stresses that, in many cases, site specific conditions may require substantially wider buffers. Therefore, the appropriate width of vegetative land strips for filtering and absorbing nutrients in the run-off varies and depends on the soil type, vegetation type, slope of the land, type of flow, and the concentration of nutrients in the run-off.

To illustrate this, consider the slope of land surrounding the wetlands. For a wetland area that has surrounding lands on a 0.05% slope, a buffer strip of 91.5 m is sufficient to remove 80% of the excess nutrients in the run-off. When this slope is increased to 4.0%, the required buffer width rises nearly three fold to 262.2 m (Vanderholm and Dickey, 1978). However it is important to note that slopes surrounding wetlands in the Great Lakes/St. Lawrence region area are significantly higher than those previously mentioned. Therefore, wetlands in this region more than likely require much larger buffer widths.

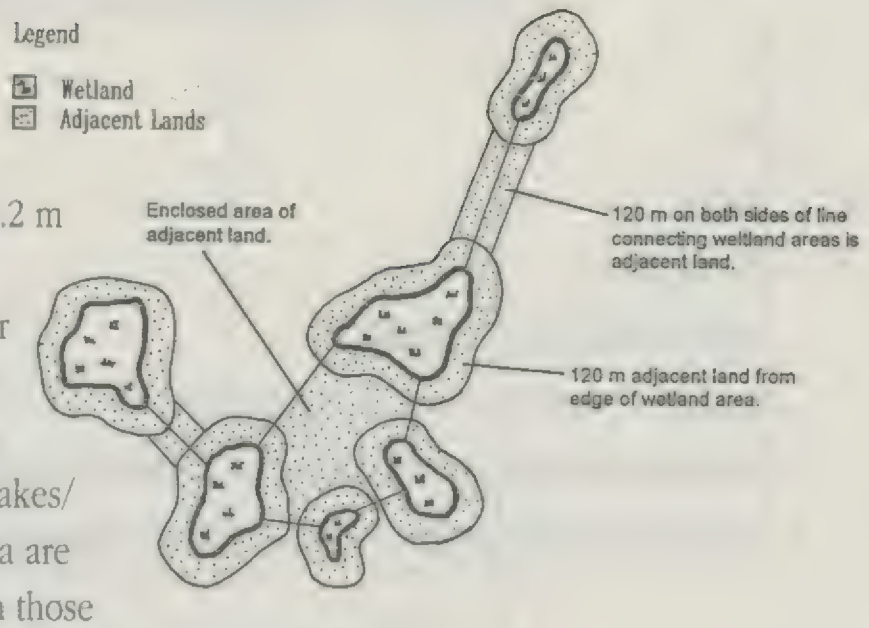
Legend
Wetland
Adjacent Lands
Enclosed area of adjacent land.
120 m on both sides of line connecting weltland areas is adjacent land.
120 m adjacent land from edge of wetland area.

Figure 2. Wetland complex. (OMNR, 1994)

Conclusions

As a result of our findings we are able to draw the following conclusions:

1) With respect to the resource requirements of wetland wildlife, adjacent lands 110 m in width appear to be sufficient for maintaining the majority of the species studied thus far.

2) With respect to nutrient run-off, the required width of adjacent lands is variable depending on the site specific characteristics of slope, soil type, vegetation type, type of flow, and nutrient concentration in the runoff. However, given even comparatively gentle slopes (i.e. 5%), buffer widths greater than 200 m appear to be necessary to control nutrient run-off.

Is the Policy Valid?

From our findings we determined that the width of adjacent land required for wetlands is site specific and depends on the specific functions and the various physical attributes of the wetlands. In light of this we feel

Table 1. Distance from the edge of a wetland travelled by wildlife.

Species	Distance	Character	Source
Racoon (*Procyon lotor*)	1500 m	max. distance travelled from nest for food (much comes from wetlands)	Grizimek, 1972
Kingfisher (*Megaceryle alcyon*)	800 m	max. distance from water that nest have been found	Peck et al., 1983
Green Frog (*Rana clamitans*)	110 m	average distance travelled within home range	Martov, 1953
Common Snapping Turtle (*Chelydra serpentina*)	74 m	average distance travelled from shoreline	Obbard et al., 1981
Beaver (*Castor canadensis*)	40 m	average distance travelled from shore for food and building materials	Belovsky, 1984
Muskrat (*Ondatra zibethicus*)	13 m	average distance travelled from shore for foraging	Proulx et al., 1983
Water Snake (*Nerodia sipedon*)	6 m	average distance travelled from shore for foraging	Tiebout and Cary, 1987
Common Loon (*Gavia immer*)	3 m	average distance of nesting site from shore	Harrison H., 1975

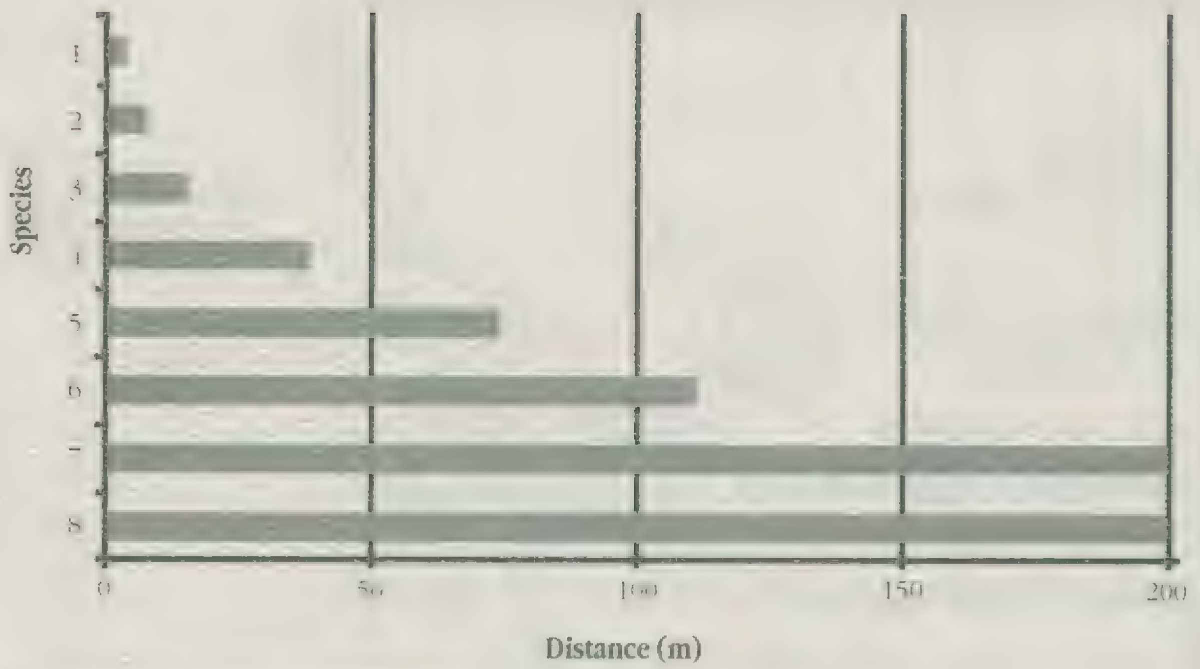

Figure 3. Distance from the edge of a wetland travelled by wildlife.

1. Common Loon (*Gavia immer*)
2. Water Snake (*Nerodia sipedon*)
3. Muskrat (*Ondatra zibethicus*)
4. Beaver (*Castor canadensis*)
5. Common Snapping Turtle (*Chelydra serpentina*)
6. Green Frog (*Rana clamitans*)
7. Kingfisher (*Megaceryle alcyon*)
8. Racoon (*Procyon lotor*)

that the 120 m adjacent land width, implemented by the OMNR Wetland Policy, is not suitable when universally applied to *all* wetlands. The sufficient width of adjacent land for one wetlands may vary greatly from that of a neighbouring wetlands, depending on their biotic and abiotic factors. Thus, although 120 m is suitable for some wetlands, it is certainly inadequate for others.

Recommendations

1) There is a definite need for more research in order to acquire specific data about the specific resource requirements of organisms living within and around wetlands (i.e. more data is required on adjacent land use by specific wetland organisms).

2) The replacement of the designation "Adjacent Land" in the policy statement with the designation of "Buffer Zone." The buffer zone being an area of land upon which *no development* is allowed under *any* circumstance (as opposed to adjacent lands that could potentially be developed).

3) Eventually there could be buffer zone designations of varying widths that match the requirements of each wetland. However due to the lack of data, we recommend that a buffer width of 200 m be implemented until further research has been done.

ACKNOWLEDGEMENTS

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Biodiversity successes and initiatives

Global biodiversity *is pleased to continue its look at biodiversity successes and initiatives around the globe. Three groups are featured. The first focuses on a Canadian tropical research station in Costa Rica—research stations are key institutions that provide a vital complement to research in universities and museums. They allow researchers to appreciate firsthand the intricacies of plant and animal behaviour, physiology, ecology, and relationships. The second focuses on the newly formed Canadian Botanical Conservation Network, a network that will strive to promote* cooperative *conservation among botanical insitutions. The third focuses on a federal government initiative—the State of the Environment Directorate and its valuable upcoming 1996 Report. [D.E.M.]*

Cano Palma Biological Station in Costa Rica

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BACKGROUND

In 1991, the Canadian Organization for Tropical Education and Rainforest Conservation (COTERC) was formed. Its creation was largely the work of two Torontonians: Marilyn Cole, a senior keeper at the Metro Toronto Zoo for 22 years with a Master's degree in Environmental Studies, and Ozzie Teichner, professional photographer and former Metro Toronto Zoo keeper. Their interest came about as the result of serving as Research Assistants on a Leatherback Sea Turtle project near the village of Tortuguero in Costa Rica in the summer of 1990. So enamoured were they of the area, its forests, and its wildlife, that they purchased a small tract of Atlantic lowland rainforest. From this small beginning, COTERC has evolved into an organization that is actively involved in conservation and has a number of significant programs and facilities. This property is now known as the Cano Palma Biological Station.

Headed up by Executive Director Marilyn Cole and primarily run by volunteers, COTERC employs two full-time individuals. Station Manager Daryl Loth is a Canadian and a graduate of the University of Toronto. Pat Opay, a University of Wisconsin graduate in Conservation Biology, acts as Scientific Officer.

LOCATION

Cano Palma Biological Station is located 4 km north of the small village of Tortuguero in Limon Province on the northeast Caribbean coast of Costa Rica. The nearest road is 100 km away at the port city of Limon. Access to the station is by a six to eight hour boat trip from Limon or a half hour plane ride from the capital city of San José.

Situated within the boundaries of Barra del Colorado Wildlife Refuge, it is bordered on three sides by rivers and by primary/secondary rainforest on the remaining side. A distance of 200 metres across the Cano Palma River separates the station from the Caribbean Sea. However, because of the dangerous rip tides and lurking sharks, the area is unlikely to be developed as a resort. The portion of the beach that is not officially protected will likely continue to be a minor nesting site for Leatherback and Green turtles. Poaching of eggs and turtles does occur, and unfortunately, the narrow strip of rainforest between the beach and the Cano Palma River has been taken over by squatters. However, the side of the river on which the field station is situated remains relatively undisturbed.

The Tortuguero region receives about 5,000 mm of rain per year and is one of the most species-rich ecosystems in Costa Rica. About 120 species of mammals, more than 300 species of birds, and more than 100 species of reptiles and amphibians have been documented. Of the 16 species of endangered mammals in Costa Rica, 13 are found in or close to the Cano Palma Biological Station. Six of the seven nationally endangered reptiles are also present in the area. The indigenous primate species include the White Faced Capuchin (*Cebus capucinus*), Geoffroy's Spider Monkey (*Ateles geoffroyi*) and the Black Mantled Howler Monkey (*Alouatta palliata*). A list of large trees and palms, incomplete at the moment, numbers 109 species, mainly of the Lauraceae, Fabaceae, Moraceae, Rubiaceae, Sapotaceae, Annonaceae, and Palmae families.

What do visitors find on their arrival at the Cano Palma Biological Station? There is a comfortable dormitory style building able to accommodate 13 visitors; it even has electrical power. In addition, there is a study/museum area, a shaded hammock area, and recently, a new kitchen/dining room/library facility has been completed. A numbered trail system winds its way through the forested area of the station. Numerous rivers, streams and lagoons are close at hand, ready to be explored by canoe or outboard motor boat.

A contribution of $125 to COTERC enables the organization to purchase another acre of land; $35 purchases a quarter acre. In return, donors receive a tax receipt and a certificate.

GOALS AND OBJECTIVES

COTERC's objectives and projects are many and varied. Some are generally educational; others, more specifically scientific. Examples follow:

One of COTERC's specific goals is to enlarge the area of the Cano Palma Biological Station, thereby conserving more of the rain forest. Costa Rica has a well-deserved reputation for preserving its rain forest and especially for its system of national parks, but ironically, Costa Rica also has the highest rate of deforestation in Central America. Tremendous pressures and threats to the rain forests come from lumber, banana, and tourism interests. A contribution of $125 to COTERC enables the organization to purchase another acre of land; $35 purchases a quarter acre. In return, donors receive a tax receipt and a certificate.

The station serves as a biological research centre for Costa Rican and foreign scientists, teachers, students, and ecotourists. Accommodations are limited, and costs for room and board are low: US$35 per day for ecotourists, US$30 for senior researchers and teachers, and US$25 per day for students. Recent student groups have come from institutions as diverse as Texas Wesleyan University to University of Toronto to Pelican Falls First Nations High School. Some current research projects include the taking of a census of plants in the region and one of fish in the Cano Palma River, the study of the behaviour of the three local primate species, research into the foraging behaviour of phyllostamine bats, and an examination of the relative abundance and diversity of the leaflitter herpetofauna.

In addition, Cano Palma operates a permanent bird monitoring observatory and banding station in conjunction with the Muséo Nacional de Costa Rica, and the station is developing a butterfly farm. The latter is a unique cooperative venture in association with local residents and has two main scientific objectives: to breed animals for exhibit purposes and to repopulate the wild. As well, it is hoped that this particular project will provide an alternative, renewable source of income for the local population as a deterrent to poaching and deforestation.

Along the same economic lines, COTERC is hoping to develop a craft cooperative with the women of the area, who have few economic opportunities in this remote, undeveloped part of Costa Rica. The sale of crafts to the inevitable and increasing number of tourists will broaden the income base of local women and enhance their lifestyle and quality of life.

Finally, COTERC is involved in environmental education in public and high school systems in Canada and Costa Rica. As well it participates in slide and public displays at such functions as "Naturefest" at Royal Botanical Gardens in Hamilton, Ontario.

FUNDING: THE ONGOING CHALLENGE

As is true of most non-profit, non-governmental organizations, funding is an ongoing problem and challenge. Revenue is generated through the sale of COTERC memberships ($15 for seniors and students, $25 for an individual, up to $100 for a corporate membership); weekly bingos held in Ajax, Ontario; the sale of T-shirts; the "Save An Acre" plan; and through payment from visitors to the station. Certainly every effort is being made to ensure that the Cano Palma Biological Station, which is providing knowledge and developing human resources in the areas of conservation and sustainable use, remains a viable, active, and operational field biological station.

✓ The Canadian Botanical Conservation Network (CBCN)

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The Canadian Botanical Conservation Network (CBCN) is a new initiative to develop coordinated participation in biodiversity conservation programs among ex-situ botanical institutions and organizations in Canada. It was officially opened on 27 June 1995 by Ms. Paddy Torsney, Member of Parliament for Burlington South, in a brief ceremony at Royal Botanical Gardens (RBG).

CBCN, a project of RBG, is at the early development stage, and so far, 15 organizations have expressed an interest in participating. The network has developed a tentative mission statement, which is "to aid the botanical gardens, arboreta, and other institutions maintaining living collections of plants in Canada to realize their potential to contribute to the conservation of biological diversity." To support this mission, CBNC has three main objectives: 1) to promote the positive effects of botanical institutions conserving rare or endangered species as important resources; 2) to increase the participation of said organizations in rehabilitating habitats and exhanging information to increase public knowledge—both of which help Canada implement its Biodiversity Strategy; and 3) to encourage development of information systems that will catalogue and use nationally important plant resources in cultivation, provide information about plant stocks and their availibility for habitat rehabilitation, and exhange information with similar international organizations.

Western Prairie Fringed Orchid (*Plantanthera leucophaea*)

At this time the network is modest. It consists of one full-time staff member, who carries out background research, makes contacts with interested organizations, and works on other development tasks. Funding support has been secured for the first two years of the project. RBG, the project leader, has contributed $25,000, and its partners Environment Canada and McMaster University have contributed $100,000 and $5,000 respectively. Two sponsors are also on board: in 1995 Glaxo Canada Inc. contributed $2,000, and Merck Frosst Canada Inc. has committed $5,000 for each of the next three years. Links have been established with international groups in England, the United States, and Australia, and it is hoped that CBNC will be patterned on the Australian Network for Plant Conservation.

A great deal of information on botanical diversity already exists in botanical gardens, universities, and other research centres. A major role for CBCN will be to find new ways to provide wide access to existing data. In the future, a variety of information will be accessible through CBCN, which will use its home page on the Web as well as more conventional methods. In addition to information on its own projects, CBCN's home page has numerous links to other sources of relevant information. Visitors can find details on Canadian and international biodiversity programs, genetic resources, botany, biology, and ecological gardening. Environment Canada and McMaster University can also be reached through the CBCN home page, and a directory of Canadian botanical gardens and arboreta is available there, too. The URL address (case sensitive) for the CBCN home page is: **<http://www.science.mcmaster.ca/Biology/CBCN/homepage.html>**.

A list of priority species of Canadian plants for conservation is being drawn up collaboratively with several organizations, and a pilot project is being initiated by CBNC. This pilot will likely focus on the Wood Poppy (*Stylophorum diphyllum*); McMaster University will study the genetic status of the limited Canadian populations around London, Ontario.

Finally, CBNC is considering organizing a workshop or conference on the development of integrated conservation programs in Canada in the summer of 1996. Please contact Dr. Galbraith immediately if you are interested in more information about the conference. Surveys about proposed CBCN programs are also in circulation and may be obtained from Dr. Galbraith.

SOED has produced world-class reports every five years that are extremely useful to industry, governments, universities, and NGOs. Due to government cutbacks, the 1996 SOE report is slated to be the last in this series. Hopefully it will have served as a model to countries around the world on how to discharge their responsibilities towards the Convention on Biological Diversity, as well as toward their own citizens. [D.E.M.]

✓ State of the Environment Directorate

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Tel: (819) 994-9533, Fax: (819) 994-5738

MANDATE, GOALS AND METHODS

The State of the Environment Directorate (SOED) has a legislated mandate to lead the preparation of a variety of SOE reporting initiatives, such as fact sheets, a report series, indicator bulletins, newsletters, videos, and other products. In addition it produces the five-year National Report on the state of Canada's environment.

A key theme underlying all SOE reporting is the link between human activities and the environment, and the ensuing implications for human and economic health and the state of ecological systems. Key elements of the reporting process are the integration and analysis of high-quality, scientifically based data, particularly the incorporation of the key environmental indicators.

RECENT BIODIVERSITY-RELATED PROJECTS

A SOED fact sheet on protecting ecosystem diversity is planned to describe the status of protected areas and the economic, social, and ecosystem roles they serve. As well, it will summarize the stresses on protected areas and outline the protected areas network.

The National Conservation Areas Data Base (NCADB) includes a broad range of protected areas from parks to ecological reserves to wildlife management areas, many of which are important for conserving biodiversity. Over 3,000 of these areas are owned by government agencies; 10,000 sites are owned by non-government organizations. Information, such as size, protection status, managing agency, and ecoregion location are key attributes of the data base.

During 1995, SOED has been developing a framework for environmental indicators of biodiversity. The first bulletin is planned for the 1995-96 fiscal year and will be updated as new data become available.

In addition, SOED has been working cooperatively with the United States and Mexico to develop hierarchical, terrestrial, ecological regions for North America. Assessing the ecological representation of protected areas will be an extension of this work.

On the "popular" biodiversity front, SOED has also just finished developing two exciting projects in conjunction with other partners. *Earth: The Changing Environment* is a CD-I, developed in conjunction with the Canadian Museum of Nature (CMN), National Film Board, Natural Resources Canada, and On-Q Corporation. *Wetlands: Cradles of Life* is a video and educational package developed with the CMN, Ottawa-Carleton Broadcast Communications, and the North American Waterfowl Management Plan.

During the past year, SOED has also contributed a great deal of ecological information to ELADA, the Electronic Atlas of Agenda 21, being developed by the International Development and Research Centre in conjunction with the Canadian Centre for Remote Sensing, the CMN, and the National Atlas Information Service. This multimedia presentation software provides a lot of information about the biodiversity of a country; the prototype focuses on Canada.

Last but not least, SOED will release the third national report on the state of Canada's environment in 1996. This report builds on the previous two reports, and for the first time, it will contain a whole chapter on biodiversity, its status and trends in Canada and the world. Overall, the conceptual approach for the Report has three elements: a focus on sustainable development (looked at from a mainly environmental perspective), the use of an ecoystem framework for presenting the information, and the emphasis on the four SOE questions (*What is happening?*, *Why is it happening?*, *Why is it important?*, and *What are we doing about it?*), which were also used in the 1991 Report. The 1996 State of Canada's Environment will be released on the Internet as chapters become available, starting in January 1996. For further information, contact 1-800-668-6767. At the time of publication, the specific Internet address is not known, but the general Internet address for Environment Canada is <**http://www. doe. ca**>.

FIRST MEETING OF ADVISORY BODY TO THE CONVENTION ON BIOLOGICAL DIVERSITY

Success in Paris

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OVERVIEW

With several world fisheries in crisis, divided opinions on intellectual property rights, and little progress being made in global sharing of benefits from biodiversity, the first meeting of the Subsidary Body for Scientific, Technical and Technological Advice (SBSTTA) promised to be spirited. The goal of the SBSTTA meetings, held in Paris at UNESCO on 4-8 September 1995, was two-fold: 1) to establish the *modus operandi* of the group, and 2) to provide advice on questions referred to them by the Biodiversity Convention's Conference of the Parties (COP) in preparation for the second COP meeting to be held in Jakarta in November 1995.

The meetings were well attended, and dynamic discussions produced concrete recommendations for the COP and created expert panels to provide additional guidance. On the whole, the climate of the discussions was businesslike, though political issues were energetically debated from time to time. Progress was facilitated by the effective chairing of the meetings by Professor Jameson H. Seyani of Malawi, and by the efficient support given by the Secretariat of the Convention on Biological Diversity, including its Executive Secretary Mr. Calesous Juma, and the host organization, UNESCO.

Participants included delegates from some 84 member countries that have ratified the Convention, several observer countries like the United States that have not ratfied, plus the United Nations Environment and Development programmes and United Nations agencies including FAO, UNESCO, and the World Bank. As well, over 50 inter-governmental and non-governmental organizations (NGOs), representing the environment, indigenous peoples, and industries, attended the SBSTTA meetings as observers, having just met in a two-day workshop organized by BioNet. From this workshop, they were able to provide a written and short oral presentation to SBSTTA, and their contribution to the conservation and sustainable use of components of biodiversity was favourably acknowledged by several delegations. Furthermore, NGOs were invited to make short presentations before the plenary sessions on several occasions, and they were allowed to make comments for national delegates to take into account in workgroup deliberations. These included trade organizations such as the Japan Fishing Association and Ornamental Fish Industry (UK), as well as NGOs and ENGOS such as World Wildlife Fund, Greenpeace International, IUCN, Species 2000, World Federation for Culture Collections, World Resources Institute, and Ocean Voice International, and indigenous organizations such as the Maori Congress and Cultural Survival Canada. Observer states, such as the United States, were also allowed to comment on issues they felt important.

ISSUES UNDER DISCUSSION

One of the issues SBSTTA was asked to focus on by COP was marine and coastal biodiversity. In response, a sessional open-ended working group was established with Peter Bridgewater of Australia acting as Rapporteur. Five informal subgroups, each with their own rapporteur, were also established to deal with:

- integrating coastal and marine area management;
- mariculture;
- the control of alien marine species;

- overexploitation of living marine and coastal resources; and
- education and awareness.

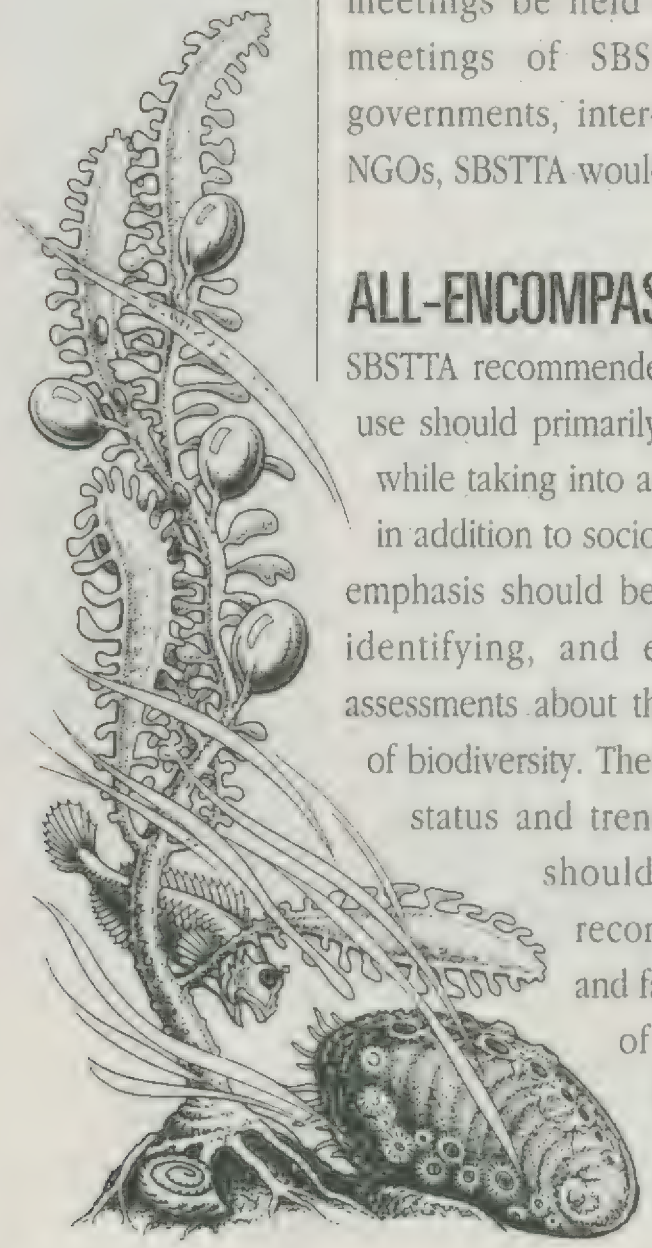
The subgroups met three times, sometimes late into the evening, and then reported to the main working group with draft papers for broader discussion and input. The draft papers were then open for discussion by SBSTTA one day before the plenary. At the plenary the papers were adopted with some revisions. The education and awareness paper was dropped for lack of time.

MODUS OPERANDI

Several decisions were made as to the *modus operandi* of SBSTTA, subject to COP approval. These include the working schedule for the group and recommend three important implementation strategies: 1) the holding of an annual meeting in advance of the COP meeting; 2) the establishment of two open-ended sessional working groups, open to all Parties and observers, which would operate during the SBSTTA meeting with clear terms of reference; and 3) the establishment, with limited duration, of up to three ad hoc Technical Panels of Experts, which would focus on specific priority issues of SBSTTA's work programme by drawing on existing knowledge and competence in other organizations. It was also proposed that further regional and subregional meetings be held to help prepare for the regular meetings of SBSTTA. From lists provided by governments, inter-governmental organizations, and NGOs, SBSTTA would also prepare a roster of experts.

ALL-ENCOMPASSING RECOMMENDATIONS

SBSTTA recommended that conservation and sustainable use should primarily emphasize the ecosytem approach while taking into acount the three levels of biodiversity in addition to socio-economic and cultural factors. Also, emphasis should be placed on describing, evaluating, identifying, and exchanging information on the assessments about the status and trends of components of biodiversity. Then, the driving forces determining the status and trends of components of biodiversity should be identified. Other recommendations involved promoting and facilitating both access to and transfer of technology and the information found in national reports on biodiversity; a potential format for the latter was included in an annex. A number of recommendations were less than concrete, suggesting further work that might be done.



RECOMMENDATIONS ON MARINE AND COASTAL BIODIVERSITY

Among many others, SBSTTA made the following recommendations on conservation and sustainable use of coastal and marine biodiversity. They are cited here in abbreviated form, and readers should note that many of the recommendations cited under "Integrating Coastal and Marine Management" also apply to the other categories.

Integrating coastal and marine management

- Establish an ad hoc expert panel on the conservation and sustainable use of marine biodiversity, which would consider gaps in the knowledge of the distribution and abundance of marine and coastal biodiversity, needs for threat alleviation and technology transfer, linkages between the status of biodiversity and management of watersheds, pollution from marine vessels, and others.
- Endorse integrated marine and coastal area management to address conservation and sustainable use problems.
- Develop research and monitoring programs to provide needed information.
- Develop representative systems of marine and coastal protected areas.
- Address the impacts of land-based activities and the impacts of desludging and pollution by maritime vessels on marine and coastal biodiversity.
- Base management decisions on the precautionary approach and the best available sound scientific knowledge, research, and information in combination with drawing upon local and indigenous community knowledge.
- Take into account ecosystem functions and processes in conservation and sustainable use.

Mariculture

- Implement environmentally sustainable mariculture, subjecting it to environmental and social impact assessments, and incorporating the participation and needs of local and indigenous peoples.
- Minimize use of chemicals for therapeutics, other applications, and high nutrient use.
- Avoid overexploitation of wild larvae.
- Undertake restoration where mariculture has substantially reduced or destroyed natural habitats and ecosystems.

The control of alien marine species

- Stem the adverse impacts of introducing alien species.
- Treat introductions of alien species, species from selected breeding, and living modified organisms that result from modern technology as introductions into the wild, and because of the potential high risks, insist that assessments be rigorous and apply the precautionary principle.
- Consult with neighbouring states before introducing alien species into shared waters.
- Prevent the introduction of alien species by applying, among others, IMO ballast water guidelines or the ICES Code of Practice.
- Prior to intentional introduction, consider the use of possible indigenous species alternatives.
- To avoid introduction of alien species, conduct environmental impact assessment prior to constructing canals linking coastal water bodies.
- Educate the public about possible dangers to the ecosystem that could result from the release of ornamental species and unauthorized releases of species for sport fisheries.
- Establish a clearing house mechanism for information on normal or pathogenic flora and parasites of aquatic species being introduced for mariculture or stocking programs.
- Propose that COP support IMO on drafting draft ballast water guidelines and request an opportunity for COP to provide input regarding Convention objectives and provisions.

Overexploitation of living marine and coastal resources

- Address the world-wide over-capitalization of fishing fleets and the role of national government subsidies via Commission on Sustainable Development.
- Make national legislation conform with the Biodiversity Convention, the Law of the Sea, and Agenda 21.
- Ensure that the (hitherto voluntary) draft FAO Code of Conduct for Responsible Fisheries is adopted, implemented, and enforced, and request opportunity for the COP to have input into the draft Code so that it is fully consistent with the objectives and provisions of the Biodiversity Convention.
- Accede, fully implement, and enforce existing international agreements that deal with over-exploitation and conservation of marine and coastal resources, especially the Agreement on Straddling and Highly Migratory Fish Stocks.
- Identify constraints to conversion of fishing gear and phase-out of overcapacity with the possibility of reducing subsidies for fisheries (perhaps through chance, the proposed idea of re-directing subsidies to converting fishing gear to reduce impacts on habitat and bycatches and reducing overcapacity, was omitted).

These recommendations on over-exploitation were formulated amidst vigorous discussion. Some recommendations, such as those on networks of protected areas, survived despite minority criticism, while others, like the development and use of selective fishing gear to reduce habitat impact and bycatch losses, the elimination of ghost-fishing, and the inclusion of catch-per-unit effort in fisheries statistics, fell to such pressures.

Other significant issues, such as protected areas and bioprospecting in areas beyond national boundaries, were not subject to enough adequate discussion to form the basis for recommendations despite the fact that these areas cover 55% of the planet. Despite their challenging nature, these issues should be resolved and acted upon, whether under the Biodiversity Convention that has an active Conference of the Parties, or under the Law of the Sea, which does not.

LOOKING AHEAD

A proposed programme of work was drawn up for SBSTTA in 1996-97. The work will include a review of assessment of biological diversity made in 1995 with advice on methodologies; a review of biological diversity indicators to assess their effectiveness; identification of sound technologies and their transfer; capacity building and its relation to the safe transfer, handling, and use of living modified organisms; the role of the clearing house mechanism; and identification and protection of knowledge, innovations, and practices of indigenous peoples and local communities and modes of compensation through equitable sharing of benefits arising from them.

Thanks to a largely positive climate of discussion, SBSSTA achieved signficant progress at its first meeting. This augurs well for COP-2, which will have a a wide-ranging set of proposals to consider in Jakarta. The delegations to SBSTTA, their Chair, Mr. Jameson H. Seyani, the Executive Secretary of UNEP, NCGOs, and other observers can be proud of the steps toward forward-looking actions made at UNESCO in September. Hopefully COP-2 will follow up on these recommendations with concrete and timely actions.

Tropical Rainforest Cube

Tropical rainforest covers approximately 8% of the Earth's surface and is found in warm, moist climates. Our ground-based perspective permits us, at first, only to see the very bottom layer of this unique, lush, and green ecosystem. The tallest trees can be as much as 60 m high, but the forest canopy generally exists as a layer 15-45 m above the forest floor. One acre of forest is roughly 63 m by 63 m. This means that the forest extends upwards for almost an equal distance – a cube of habitat rather than an area. Increasingly, research is focusing on the canopy, which is the most biologically rich layer of a complex and diverse ecosystem. There is now an Internet canopy group (see p.30 for more information). Biodiversity, in all its aspects (genetic, taxonomic, ecosystem or habitat, and ecoservices), is high there. Energy flow is also high there, with the full force of the tropical sun striking the top of the canopy. Available moisture is also there with rainfall dripping off leaves and branches onto epiphytes, which absorb part of the rainfall before it strikes the forest floor. Habitat and diet specialization contribute to genetic diversity, species numbers of many taxa are highest here, and habitat diversity is very high due to the complexity of flora growing around, in, and on other plants. Nutrients are transported rapidly up into, and within the canopy, and then are rained back down to the forest floor, completing the cycle. Few of the nutrients lodge in the soil; invertebrates, fungi and other soil organisms quickly convert old life into new nutrients, which are rapidly picked up by growing plants. Full, fecund life is an integral characteristic of this forest.

Biodiversity news

Recent polls support strong environmental laws in the U.S.

According to a new poll conducted by ABC News and *The Washington Post*, 70% of Americans think that the federal government has not gone far enough to protect the environment. An additional 11% consider the government to have reached a happy balance for environmental protection. *The Tri-City Herald* recently asked its readers whether they support or oppose Senator Gorton's proposed Endangered Species bill, which would severely cut back on the power and effectiveness of the *Endangered Species Act*. *Herald* readers, residents of conservative Benton and Franklin Counties in eastern Washington, responded en masse. Sixty-nine percent said they do not support Gorton's proposal.

Latest news on taxol: First effective new treatment in a decade for ovarian cancer

Data presented at the annual scientific meeting of the American Society for Clinical Oncology show that the drug taxol derived from the Pacific Yew tree "has proven to be the first effective new treatment in a decade for ovarian cancer," the Associated Press reported. Richard L. Schilsky of the University of Chicago said taxol is likely to become the first line treatment for deadly ovarian cancer. The results are "very persuasive," Schilsky said. "This is a substantial improvement."

Ovarian cancer will strike an estimated 27,000 women in the United States this year. [From ESA TODAY on Internet, Wed. 24 May 1995, from the Endangered Species Coalition. For more information call (202)547-9009.]

Earth Charter to be presented to United Nations on its 50th anniversary

The Earth Council in San José, Costa Rica is reviewing the continuing efforts initiated by NGOs and governments during the Rio process. They are consulting ecumenical organizations in ten Latin American countries about the Earth Charter. An agreement has been signed with the International Green Corps to implement this initiative with a view to presenting the Earth Charter to the United Nations on the occasion of its 50th Anniversary in 1995.

Antarctic Treaty

In May 1995 delegations from 42 countries to the Antarctic Treaty Consultative Meeting met in Seoul, Korea. Their goal was to create a body to monitor damage to the Antarctic environment. The Antarctic Treaty has not yet come into power; only 14 of the 26 treaty members have ratified the protocol calling for stricter environmental standards. [*Ottawa Citizen*, 9 May 1995.]

Carbon tax leadership

Taxation on carbon-based fuels, such as petroleum products and coal, provides an incentive to reduce emissions of carbon dioxide that foster the greenhouse effect. Several countries are providing leadership in this area; others lag behind. Combating the greenhouse effect is essential if we are to avoid widespread losses in biodiversity. The Netherlands has not only imposed a carbon tax but has taken a cooperative approach with its manufacturing industry, which has agreed to improve energy efficiency by 20% by the year 2000 on a sector-by-sector basis. Tax breaks are being offered to accelerate the introduction of certain technologies that will reduce greenhouse gases. The four Scandinavian countries (Finland, Sweden, Norway, and Denmark) have all applied carbon taxes with a wide variety of exemptions to reduce the impact on energy-intensive industries. [*Terrascope* 1(3): 1, 4]. Countries in North America, inhabited by people who consume extremely high amounts of energy, are only engaged in planning voluntary approaches to carbon dioxide emission reductions, which does not bode well for moderation of global warming. Shouldn't North American governments follow the lead of the Netherlands and Scandanavia and impose taxation to hasten incentives for reducing greenhouse gases? [D.E.M.]

Canada's Rio Summit Report Card–1995

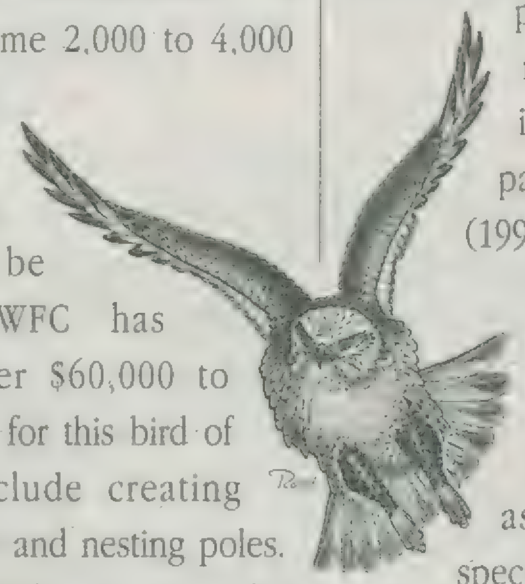
The Sierra Club of Canada has issued its Third Annual Rio Report Card marking how successful Canada has been in fulfilling its commitment made at the United Nation's Conference on Environment and Development in June 1992. The following marks were awarded for commitments:

Increasing Overseas Development Assistance to 0.7% of GNP — **F**
Reducing greenhouse gases — **D+**
Protecting biodiversity — **C**
Reviewing and reforming pesticide policies — **D**
Establishing environmental assessment of projects — **B-**
Making trade and environment mutually supportive — **F-**
Protecting the high-seas from overfishing — **C**
Promoting the knowledge and concerns of indigenous peoples — **F**
Incorporating environmental concerns — **D**
Protecting forests — **C+**.

Each item was provided with an analysis. For example, the Fisheries Minister is given credit for efforts to enforce quotas on trans-boundary stocks and to support recommendations on B.C.'s missing salmon. However, he was marked down for failing to follow through on establishing marine protected areas, and for permitting the harvests of capelin (for the roe) and Canadian turbot. [Sierra Club of Canada, 1 Nicholas Street, Suite 620, Ottawa, ON K1N 7B7.]

Ferruginous hawk status improved but eight new species at risk

The World Wildlife Fund Canada (WWFC) reports that the Ferruginous Hawk's status in Canada has improved from "threatened" to "vulnerable." Some 2,000 to 4,000 pairs remain in the wild and the bird's numbers appear to be increasing. WWFC has contributed over $60,000 to recovery projects for this bird of prey; these include creating artificial nest sites and nesting poles. The Burrowing Owl's status, on the other hand, has been changed from "threatened" to "endangered."



Eight new species have been added to Canada's List of Endangered Wildlife and Other Species at Risk. There are three threatened species: the White Wood Aster (*Aster divaricatus*); Golden Paintbrush (*Castilleja levisecta*); and the Yellow Montane Violet (*Viola praemorsa praemorsa*), plus five vulnerable species: Ord's Kangaroo Rat (*Dipodomys ordii*); Bolander's Quillwort (*Isoetes bolanderi*); Queen Charlotte Goshawk (*Accipiter gentilis laingi*); Cryptic Paw Lichen (*Nephroma occultum*); and the Hare-Footed Locoweed (*Oxytropis lagopus*). These bring Canada's List to 263 species at risk. [*Working for Wildlife,* Summer 1995, p.1, 4-5.]

It should be remembered that the List is incomplete in two senses. First, certain taxonomic groups, like fishes and vascular plants, that are included in the List are only partially surveyed and categorized by the Committee on the Status of Wildlife in Canada (COSEWIC); more species can be expected to be added from those groups. Second, there are numerous invertebrates, microorganisms, and lower plants that are not currently being evaluated at all. (See Dr. Aniskowicz's discussion on the EPIC program's efforts to have non-vertebrates included in COSEWIC's work on page 4-7.) Mosquin et al. (1995 *Canada's Biodiversity,* Canadian Museum of Nature) give an estimate of several thousand species at risk in Canada as opposed to the 263 species officially listed. They arrived at their estimate by applying the percentages of those species at risk in relatively well studied land vertebrates and vascular plants to estimates of the total number of species (known plus unknown) for Canada. [D.E.M.]

U.K. continues to fund Darwin Initiative biodiversity projects

A further 33 international biodiversity projects will benefit from the unique expertise of academic and scientific institutions in the United Kingdom (U.K.) under the government's Darwin Initiative, announced Environment Secretary John Gummer. The U.K. has committed another £3 million to the Initiative.

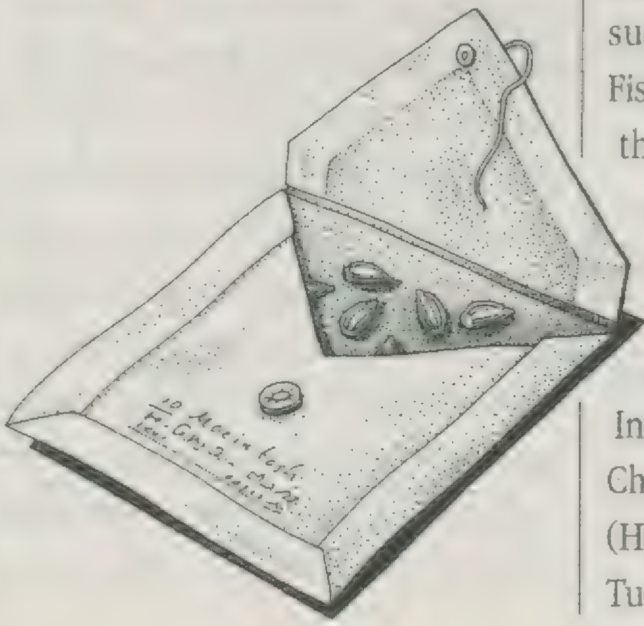
This brings the total number of projects to 86 since November 1993 and the total funding to almost £9 million. Collaborative links have been made or strengthened to over 50 countries across four continents, involving over 60 U.K. institutions. "There are few better teachers of recording, conserving, and monitoring species than those at centres of scientific excellence like Kew and The Natural History Museum," said Gummer. He stated that Darwin capitalizes on these strengths: some of the U.K.'s best scientists and technicians are transferring their knowledge and skills to people in the less developed countries of the Southern Hemisphere who will then stay and carry out work to conserve plants and animals in the future.

The new projects include a study on sharks, rays, and sawfish by the IUCN in Malaysia and a study on native oyster species by Plymouth Marine Laboratory in Thailand. Another project will involve local people in Paraguay's Mbaracayu rain forest where a three-year £200,000 project will produce an inventory of the forest nature reserve. Most projects will include an element of training to make sure that lasting benefits will be retained when funding ceases and the British scientists return home. [U.K. Department of the Environment news release, 30 March 1995].

The U.K. is to be congratulated for this follow-up to the Earth Summit. Even if the program is not large by funding standards in the development world, it has been sustained. Dependable funding is one of the most important stimuli to scientific productivity and to the benefits that flow from it. The Darwin Initiative could well serve as a stimulus for other developed countries to follow suit, linking North and South, especially if the training was accompanied by sustaining grants for both institutional development and much-needed infrastructure in the South. [D.E.M.]

Genetic bank for food crops threatened

One of the nation's richest troves of biological diversity resides in a cavernous, nondescript building at Colorado State University. The National Seed Storage Laboratory houses more than 200,000 seed samples, many from plants that have become extinct in the wild. Distressingly, this treasure is being lost. Fully one-third of the samples in the seed banks have germination rates below prescribed standards, and thousands of samples are dead or dying. At the same time as traditional crop varieties grown in the developing world and wild crop relatives growing in the tropics are disappearing, American crops have become dangerously uniform. Because each of these major crops is represented by only a handful of varieties, they are uniformly vulnerable to new pests and diseases. The disappearing genetic resources mentioned above are critical for breeding more diverse, pest- and disease-resistant, robust crops that can be farmed sustainably. Yet this problem has been entirely absent from debates about conserving biodiversity. [P. Raeburn, <**bene@straylight.tama.edu**> 28 Sept. 1995.]



Organic farming more profitable than conventional farming

Organic farmers receive higher financial returns from their crops than conventional farmers, according to a recent study by Canadian agricultural economist, Peter Stonehouse of the University of Guelph, Ontario, Canada. Stonehouse compared 7 organic farmers, 9 farmers who used reduced amounts of chemicals, and 11 conventional farmers. In terms of profitability, he found that organic farmers came out ahead, and conventional farmers were at the bottom of the pile. Part of the reason for the profitability of organic farming is the fact that organic produce attracts a premium price from consumers. However, profitability is also increased by lower production costs.

The study was funded under the Ontario Minister of Agriculture, Food and Rural Affairs' Food Systems 2002 Program. The program aims to reduce farmer's dependence on chemical pesticides by 50% by the turn of the century. [*Natural Life*, July-August 1995, Issue 44: 17.]

Sea turtles at risk because of shrimp trawling

On 6 July 1995, environmentalists sued the U.S. National Marine Fisheries Service (NMFS) for violating the *Endangered Species Act* and allowing sea turtles to drown in large numbers in shrimp nets. The lawsuit, filed by the San Francisco-based Earth Island Institute, Carole Allen, Founder and Chair of the Houston-based HEART (Help Endangered Animals - Ridley Turtles), and the Humane Society of

Kemp's Ridley Turtle
(Lepidochelys Kempii)

the U.S.(HSUS), aims to "prevent the continuing slaughter of threatened and endangered sea turtles by the commercial shrimp trawling industry in the Gulf of Mexico and southern North Atlantic ocean waters." Already this year more than 871 turtles, including 123 critically endangered Kemp's Ridley turtles, have died as a result of being stranded.

This follows a disastrous year in 1994 in which more than 2,400 turtles were stranded, including 573 Kemp's Ridleys. As required under the *Endangered Species Act*, a biological opinion was issued on 14 November 1994 following the massive drownings that year. In it the NMFS wrote that "the continued long-term operation of the shrimp fishery in the near-shore waters of the southeastern United States is likely to jeopardize the existence of the highly endangered Kemp's Ridley sea turtle." The opinion allowed shrimpers to continue to shrimp in 1995 if their documented incidental take did not exceed 8 Kemp's Ridleys or more than 40 sea turtles in total, and NMFS committed itself to carry out an "Emergency Response Plan" to ensure compliance in 1995.

Given the mortality numbers and the limited action on the part of the NMFS so far this year, the legal suit was filed by environmentalists. It calls for an injunction to prohibit shrimping in times and areas where sea turtles are known to occur in large numbers, until the government can ensure that shrimping activities will not jeopardize the continued existence of the listed species. This area includes near-shore waters in parts of Texas and Louisiana and is only a small part of the range of the shrimp fishing fleets of the Gulf of Mexico.

The turtles that have washed up dead represent only a fraction of those actually killed. Many die and never wash ashore, and some that wash ashore are never found. Evidence suggests that some of the turtles are being maliciously mutilated, either to send a message of non-compliance, or to increase the likelihood that cut-up turtles will sink or become shark food, thus destroying the evidence.

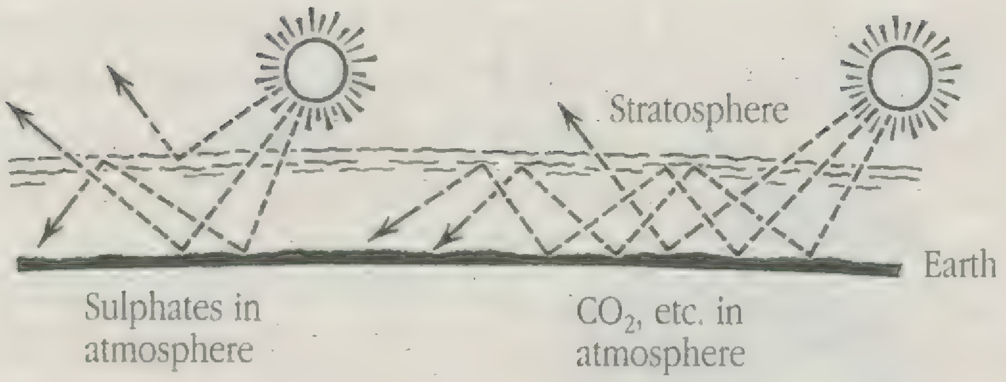
The drowning of sea turtles in shrimp nets can be easily avoided by using a safety device called a turtle excluder device or TED. TEDs are more than 97% effective at releasing turtles alive, are inexpensive (cost between $50 and $400 per net), and result in no appreciable loss of shrimp. "Earth Island is ready to work with shrimpers who are correctly using TEDs to convince the American public to purchase Turtle-safe™ shrimp," said Todd Steiner, Director of the Earth Island Institute's Sea Turtle Restoration Project. "But until the responsible shrimpers come forward and take a stand, we're advising the public to stop eating Gulf shrimp at this time."

Shrimp fishers in the Gulf have been quick to blame their economic woes on turtle-saving regulations issued under the *Endangered Species Act*. Environmentalists are quick to point out that the shrimp fishery in the Gulf is not sustainable, and they also note that this is another failure of NMFS to adequately regulate the fisheries or protect endangered sea turtles. Steiner said, "The facts are clear. The shrimpers are overfishing the resource, the fishery is overcapitalized, and NMFS is doing nothing to limit entry. This is a disaster occurring right before our eyes—what is happening to the turtles is only a symptom of what's happening to the marine environment. Turtles, shrimpers, and the ecosystem are all the losers." [Condensed from a press release from Brian West at the Sea Turtle Restoration Project. Tel: (800) 859-SAVE/e-mail: **<seaturtles@ earthisland. org>**/ www:**<http:// www.earthisland. org/ei/>**.]

Global Warming 101: Improved climate model matches temperature record

The latest results from the highly respected Hadley Climate Centre in Britain replicate the historical temperature record much more closely than previous analyses. These results significantly increase confidence in the projections of climate change due to greenhouse gases. Presented to delegates at the recent Berlin Climate Summit, the findings are summarized in a special report prepared by the Centre (*Modelling Climate Change: 1860-2050*). The simulations project global warming of almost 1.6°C by 2050 A.D. (!) based on a business-as-usual discharge of greenhouse gases (i.e. one percent per year increase in concentrations).

The improved consistency between the model simulation and observations is a result of including the effects of human-produced sulphate particles in the analysis, which used the most sophisticated modelling techniques available anywhere in the world. The Hadley Centre results are the first to include sulphate particles in a time-dependent simulation using a coupled atmosphere-ocean general circulation model.



The diagram illustrates the different effects of carbon dioxide and sulphur on global warming. Carbon dioxide gas high up in the stratosphere allows the sun's rays to pass into the atmosphere, and then traps these rays, as if in a greenhouse. In contrast, the effect of microscopic sulphur crystals in the stratosphere is to reflect many of the sun's warming rays back into space, contributing to the cooling effect.

Previous model results that did not include sulphate particles predicted an increase in global temperature since pre-industrial times of about twice the magnitude that has been observed to date. Including sulphates brings modelled- and observed-temperature increases to within one-tenth of a degree. Looking forward over the next several decades, the greenhouse warming effect is expected to be increasingly dominant over the sulphate cooling effect, so that by 2050 the warming projected with sulphates is about 60% of the warming projected with greenhouse gases alone.

There can be little comfort in this sulphate-induced downward adjustment to the temperature projections, however, because the atmospheric lifetime of carbon dioxide is 50 to 200 years, compared with about two weeks for sulphates. This implies that any future decision to switch to cleaner energy sources or to curtail sulphate emissions to reduce regional pollution would result in an acceleration of the warming rate. This is particularly true at the regional level because the short atmospheric lifetime of sulphates prevents them from being uniformly distributed around the globe. Indeed the patchiness of the sulphate effect is being used to look for regional patterns of climate change that represent a fingerprint of human activity. While the results have to be considered preliminary at this point, more and more scientists are becoming convinced that the patterns they are seeing are far more likely to be due to pollution than to chance. [Daniel A. Lashof, Ph.D., Natural Resources Defense Council U.S.A.]

Modelling Climate Change: 1860-2050 is available from Dr. D. A. Bennetts/Hadley Climate Centre/ London Road/Bracknell, Berks, RG12 L2SY/ UK/Tel: 44 1344 856 653/Fax: 44 1344 854 898/e-mail: **<dabennetts@meto.govt.uk>**.

Marine sanctuary used to monitor fishing gear effects on seafloor

Scientists from the National Biological Service and the National Oceanic and Atmospheric Administration are researching the effects of fishing gear and storms on the sea floor of the Stellwagen Bank National Marine Sanctuary near Massachusetts in the United States. A long-term goal is to understand the relationship between ocean habitats and distribution of fishes and other ocean-bottom plants and animals. The first part of the study was completed in December 1994 and included the mapping of the 1,652 km² reserve with detailed sonar records. The National Biological Service will also collect data on the biological habitats of Stellwagen Bank, an underwater plateau that sits between the Gulf of Maine and the mouth of Massachusetts Bay. [*Fisheries* 20(3): 48-49; March 1995.]

The Arctic sea ice is shrinking–quickly!

Norwegian measurements show that Arctic sea ice has been decreasing in area more rapidly in the last 6 years than in the previous 9 years before that. Microwave data from satellites for the periods 1978 to 1987 and 1987 to 1994 show the rate of decrease in extent of Arctic ice has accelerated, according to Martin Niles and colleagues at the Nansen Environmental and Remote Sensing Centre in Bergen. Although climate models suggest that the polar regions are most sensitive to global warming, it is too early to say that the shrinkage in Arctic ice represents a long-term trend. [*Nature*, 376: 127-128, 13 July 1995.]

Europeans drop policy on patenting genes, cells and biological material

The European Union (EU) has dropped a directive seeking to establish common standards for patent protection on biotechnological inventions. The EU was unable to agree on the directive, which would have established rules on patentability of genes, cells, and other biological material from humans, other animals, and plants. The draft directive made a distinction between a "discovery" that would not have been patentable and an "invention" that would have been patentable. Under the directive, cells, complete genes, or proteins would only have been patentable if they were part of an invention to carry out a specified function. Environmentalists and animal rights groups, who reject the principle that life is patentable, were pleased. Genetics researchers, however, believe that the decision gives commercial companies too much control over genetic data, which in turn could restrict research. The biotechnology industry, which originally pushed for a new directive, does not seem unduly disturbed by the failure to approve it.

Religion and healing the endangered Earth

The environment urgently needs healing, agreed some 1,000 participants representing many of the world's religions. Delegates gathered in Rome and Riva del Garda, Italy in November 1994 for the Sixth Assembly of the World Conference on Religion and Peace (WCRP). WCRP concluded, "We have dominated nature as if we were entitled to do so. This arrogance is a root cause of the present ecological crisis. Religious communities, working jointly, have much to contribute to the development of a common environmental ethic calling for new ways of thinking and a new lifestyle. Religious communities should make it a priority to educate their members, especially their children, in the common environmental ethic."

World Wildlife Fund (WWF) acted as the rapporteur (person/group charged with recording the discussions in the workshops or working group) and also made a major presentation to the WCRP meeting. WWF recommended that WCRP establish a formal environment commission and suggested opportunities for action.

The group concluded, "WCRP should summon the will and the power of the spiritual traditions of the world to affect achievable, realistic change in government and business for the good of the Environment," and listed several specific areas of work. For more information, copies of the statements, or information on WCRP chapters in your country contact: (in USA) WCRP/77 United Nations Plaza/New York, NY 10002/USA; or (in Switzerland) WCRP/14, Che. Auguste-Vilbert/1218 Grand-Saconnex/Geneva, Switzerland [*WWF Conservation, Religions & Spiritual Beliefs Network Newsletter*. March 1995: 2.]

Report on Canada's National Marine Systems Plan Now Available

In the summer, "Sea to Sea to Sea: Canada's National Marine Conservation Areas Systems Plan" was released by the Minister of Canadian Heritage. The report sets out Parks Canada's approach for developing a national network of marine protected areas. The agency's long-term goal is to create a conservation area in 29 marine regions. This document is available, free of charge, in both French and English. Please contact Claude Mondor/Chief—Area Identification/Parks Establishment Branch/ National Parks Directorate /Parks Canada/Dept. of Canadian Heritage/ 25 Eddy St., 4th floor/Hull, Quebec K1A 0M5/Canada.

The Canadian Museum of Nature goes to Africa!

Last June, the Canadian Museum of Nature (CMN) carried out the first part of its agreement with the Guinean Department of Energy and Environment to develop a national country study for Guinea. This agreement, signed in December 1994, is a direct spin-off of the Convention on Biological Diversity. By signing this Convention, Guinea and the other 150 signatory countries committed themselves to developing strategies and implementing action plans.

Canada itself acted quickly after the ratification of the convention in December 1992. Environment Canada opened up discussions at several levels to develop its biodiversity strategy. Shortly afterwards, several provinces followed suit by developing strategies for the implementation of the Convention in their own jurisdictions. The CMN developed Canada's country study and also collaborated with the Bahamas, Cuba, Costa Rica, and most recently, Guinea and participated in the development of their country studies and national strategies, among others.

After developing a National Plan of Action for the Environment, Guinea called on the professionnal services of the CMN. Guinea is now preparing its country study with help from United Nations programs, using funds from the Global Environment Facility. That document, a compilation and analysis of the biological and socioeconomic components of the country, will be the cornerstone for the development of a strategy.

In collaboration with the Guinean government, the CMN, in a strong position because of its scientific competence, is providing the services required for the implementation of the Convention on Biological Diversity in Guinea. Acting as international specialist, the CMN took part, in the spring of 1995, in the official launching of the country study, which was developed to carry out a critical analysis of the information on biodiversity and an evaluation of the general state of biological diversity in Guinea, both at the taxonomic and ecological levels. This winter, the CMN will go back to Guinea to validate the data gathered by Guinean specialists. Finally, the CMN will participate in regional seminars in each of the four ecosystems to ensure that the country study reflects the actual situation and to determine the level of awareness by, and participation that can be expected from, the locals. Financing is being sought for this next step. During the winter, the CMN will also work with Burkina Faso to start development of its country study.

The expertise acquired from this project is invaluable and can be used as a model for similar projects in Africa. This work could be the basis for the development of strategies for the conservation of biodiversity and the sustainable use of resources for West Africa as a whole. Given the vastness of the ecosystems in Africa, the Guinean country study will serve as a model for the development of others. It is even possible that one day we will be talking about global strategies for the conservation in biodiversity of Sub-Saharan Africa. [Jean Lauriault, environmental specialist, CMN, <**jlauriault@musnature.ca**>]

Photo by Jean Lauriault

Our readers write:

On 5 October 1995 "The World at Six," a Canadian Broadcasting Corporation news program, reported that Conservation Officers had seized 84 bear paws from a Chinese merchant in Vancouver. The shooting of 21 bears for an illegal trade in body parts may represent only a small percentage of the actual trade, and it is fortunate that Conservation Officers are getting a handle on this.

I do not wish to detract from this substantive accomplishment, but there are several issues that are very troubling to me. Conservation Officers in British Columbia have killed an average of 400 black bears a year for the last 10 years; more than 99% were shot simply because they wandered too close to habitation. This translates to 16,000 "legal" paws. What type of conservation is this? Last week, I personally encountered a pile of 14 rotting bear carcasses (56 paws) at the edge of a logging road near Queen Charlotte City and these bears had been shot by Conservation Officers with the passive consent and support of the public. This legal slaughter is certainly just as unethical and just as unacceptable as the illegal killing of bears for their gall bladder or paws. [T. Reimchen/Box 970/ Queen Charlotte City, BC VOT ISO/ Tel. and Fax (604)559-8648/e-mail: **<REIM@UVVM.UVIC.CA>**.]

SEEING TREES

See those trees, see their shape.
Those three stems have one trunk
into the ground. See that single stem
next to it? How the tree leans
out of the shadow zone growing
toward leaf light.

Do you see the shadow zone, as the
sun arcs, as the sun season
wobbles low, then high?
The buds receive light, are stimulated,
the branching is steered.
Yes, accidents happen, sleet weights
beyond elasticity, the cold is brittle.
Yes, age opens an adjoining niche.
Limbs progress there, weight is added.
The knot is a fulcrum, joining limb
lever to trunk. Leaf sensors
shape the crown. The seasons
clock growth into the light, missing
shadow.

Do you see the void, the missing
tree? There is the remnant,
a rotting 30 year stump.
It is an oak.
Its crown filled
the sky there. See those saplings.

Bruce Bacon
Minneapolis, Minnesota

Cyberdiversity:

Biodiversity and the Internet

Texas Natural History Collections and other biodiversity resources on-line

The Texas Natural History Collections (TNHC), a division of Texas Memorial Museum of the University of Texas (UT) at Austin is pleased to announce availability of collections databases and collections-related files:

<http://www.utexas.edu/depts/tnhc/.www> or **<gopher://gopher.utexas. edu:3003/11/pub/tnhc>** or follow gopher menus: Texas/ University of Texas Austin/ Colleges and Departments/ College of Natural Sciences/Texas Natural History Collections. WAIS-indexed databases from the ichthyology and herpetology collections are searchable, and data from other divisions (geology and invertebrate divisions) will soon be added.

We are also pleased to provide related collaborative projects through the same location.

- The WWW pages of DESERT FISHES COUNCIL include the complete bilingual proceedings of its meetings; photographs of fishes; distribution maps; and abstracts of biology, conservation status, and management of selected fish species.
- The Business Office of the American Society of Ichthyologists and Herpetologists, now based at the TNHC, provides an updated membership directory, meeting announcements, and general information about the society.
- The UT-Biodiversity Resources and Collections (UT-BRAC) collaborative project provides links to other natural history and biodiversity resources at UT. For instance, currently the Plant Resources Center and Vertebrate Paleontology Lab join the TNHC with on-line databases and related files. Links to other UT natural history and biodiversity-related collections, and to external regional biodiversity resources, will be added in the near future.

If you experience any difficulties accessing these files, or if you have any comments or questions, please contact: Dean A. Hendrickson, Curator of Ichthyology at **<deanhend@mail.utexas.edu>**; David C. Cannatella, Curator of Herpetology at **<catfish@mail.utexas.edu>**; or Carol K. Malcolm, Collections Manager for Ichthyology and Herpetology at **<cmalcolm@utxvms.cc.utexas.edu>**.

Species 2000 Programme Discussion Group

The Species 2000 Programme aims to develop a database of all animal, plant, and microorganism species in the world. (For more information see *Global biodiversity* 5(1): 29-30). An Internet discussion group to stimulate debate amongst those interested in the Species 2000 Programme has been established.

To join, send a message to: <mailbase@mailbase.ac.uk> with a single line of text: <*join species-2000 your first name your surname*>. Leave spaces between 2000 and your first name, and between your first and second names. Don't forget the hyphen between species and 2000 or it won't be accepted.

Announcement of the International Canopy Network (ICAN)

Participants at the recent International Canopy Symposium at The Marie Selby Botanical Gardens in Sarasota, Florida, agreed to establish the International Canopy Network (ICAN). This organization exists to facilitate communication among individuals and institutions concerned with two main things: 1) research, education, and conservation of organisms, and 2) the interactions in forest canopies.

ICAN brings together activities formerly carried out by the Canopy Research Network (CRN), which facilitated communication among canopy researchers, and The Canopy Institute (TCI), a not-for-profit organization to facilitate conservation through interpretation of canopy research to non-scientists. Uniting these two organizations combines the structure of a tax-exempt corporation with 501(c)3 status and the networking capacity of the CRN. By including researchers, educators, conservationists, and arborists under one "crown," links among these groups will be facilitated.

Currently, the Board of Directors consists of six members who represent the constituent fields mentioned above. The Directors serve two-year terms and meet semi-annually, or as needed. The Board will expand or change to reflect the interests of the ICAN. An Advisory Council will also be formed; the up to 20 members will take part in decisions on an *ad hoc* basis.

Some of the current core activities of the ICAN include maintenance of the e-mail bulletin board, circulation of the quarterly newsletter (titled *What's Up?*), maintenance and expansion of a citations bibliographic database on aspects of canopy science, and a directory of researchers.

Future activities will include the initiation of an images library (slides and video), a directory of museum collections of arboreal organisms, and the creation of interpretive posters for school children. Also, individuals may take on projects of interest to them, and share results and products with the rest of ICAN. For example, two individuals are investigating the use of MOSAIC for communication of text and graphical materials for those electronically connected to the network.

Until now CRN activities have been supported by a National Science Foundation grant, which will terminate in 1995. Therefore, a subscription arrangement needs to be set up so that the organization can be self-supporting in the long term. Although not finalized, it is anticipated that an annual membership will be between U.S.$20 and U.S.$50, with a sliding scale to accommodate all participants. Details on subscribing will follow in the January 1995 newsletter. In the meantime, you can send in suggestions, nominations for the Advisory Council (including yourself), or volunteer for any activity that would contribute to the network.

For more information on the ICAN, contact Nalini Nadkarni at **<nadkarnn@elwha.evergreen.edu>** or Joel Clement at **<clementj@elwha.evergreen.edu>**. The network's address is **<canopy@lternet.edu>**. [Vltolini.]

Information resource on release of organisms into the environment (IRRO)

The IRRO is a global referral service providing information resources on the releases of organisms into the environment. It is an initiative of the United Nations Environment Programme (UNEP), and is not-for-profit and grant supported. An international Steering Committee provides direction for the development of IRRO. A Secretariat based in the U.K. is responsible for putting the various programs into practice. The on-line services are managed by the Base de Dados Tropical (BDT) in Brazil with an additional node at the World Conservation Monitoring Centre (WCMC) in UK.

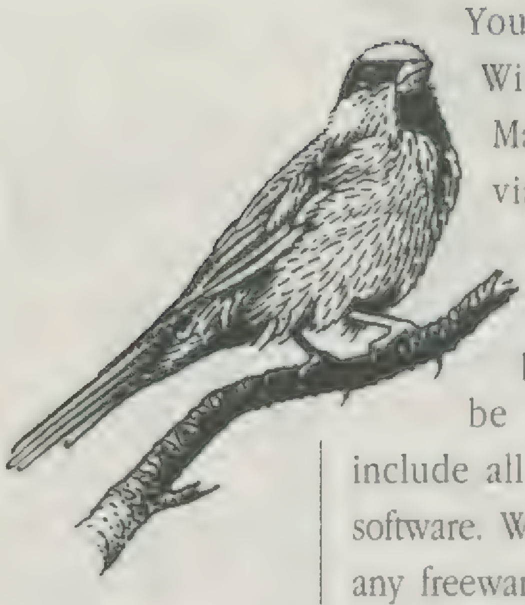
IRRO databases may now be accessed through the World Wide Web on the server at Base de Dados Tropical in Brazil at the following URL address: **<http://www.bdt.org.br/irro/irro.html>**. [IRRO SECRETARIAT, Sunil Nandi/MSDN/63 Wostenholm Road/Nether Edge/Sheffield S7 1LE/England, UK/Tel: +44-114-2583397/Fax: +44-114-2583402/e-mail: **<msdn@sheffield.ac.uk>**.]

Ontario's Environmental Registry on-line

Under the province of Ontario's Environmental Bill of Rights (EBR) residents can get involved when the government makes decisions that significantly affect their shared environment. The province's Environmental Registry provides information on the EBR and on proposals for environmentally significant laws and programs. As of 1 April 1995, all ministries must post environmentally significant policies and acts. The Environmental Registry is computerized and can be reached on Internet at **<telnet 192.75.156.92>**. You don't need a user name.

The NBS's Inventory and Monitoring Section is now on WWW

The Web address for this section of the U.S. National Biological Service (NBS) is **<http://www.im.nbs.gov/>**, and there you can reach the following data sets (and their respective data request forms): North American Breeding Bird Survey (BBS), Christmas Bird Count, Breeding Bird Census, and Bird Banding Lab. For instance, visit the BBS home pages where relative abundance maps, trend maps, annual index graphs, tables of trend estimates, and photographs of hundreds of bird species are posted. Information is also available on the following programs: North American Amphibian Monitoring Program, Butterfly Monitoring Research Program, Bio-monitoring Environmental Status and Trends, National Water-Quality Assessment Program, and Gap Analysis Program.



You can also download Wildlife Monitoring and Mark-Recapture Software via our FTP site: <**ftp.im.nbs.gov**>. This site has a number of programs already, but will be greatly expanded to include all The Wildlife Societies' software. We accept contributions of any freeware related to inventorying and monitoring plants and animals.

Future developments include: implementing a similar style of formatting to the BBS system for the data of the Christmas Bird Count; announcing a Migration Monitoring Program; putting the Monitoring Avian Productivity and Survivorship program on-line; and developing links to other inventory and monitoring sites and a data-archiving repository for monitoring data. A cache of monitoring protocols will also be available for downloading.

Please direct any further questions to the Webmaster, Brett Hoover/Tel: (301) 497-5819/e-mail: <**brett_hoover@nbs.gov**>.

Access data sets from the World Bank

The Consortium for International Earth Science Information Network (CIESIN) and the World Bank are pleased to announce experimental Internet access to two major World Bank data sets: The Social Indicators of Development, 1994 can be accessed through <**http://www.ciesin.org/IC/wbank/sid-home.html**>, and The Trends in Developing Economies (TIDE), 1994 through <**http://www.ciesin.org/IC/wbank/tde-home.html**>. If response is active and positive, similar (or enhanced) Internet access to additional World Bank data sets may be provided.

In each case, any user with a forms-capable WWW browser (i.e. IBM Web View, Mosaic, Netscape, Prodigy) can directly query the contents of these two World Bank data sets. These data sets are also searchable using CIESIN's Gateway — a distributed search and retrieval tool enabling access to a large collection of information about human interactions in the environment. For more information on the Gateway, see <**http://www.ciesin.org/gateway/gw-home.html**>.

"Social Indicators of Development" contains the World Bank's most detailed data collection for assessing human welfare and provides a picture of the social effects of economic development. Data are presented for more than 170 economies, omitting only those for which data are inadequate. Emphasis is on country-by-country review, and up to 94 indicators are reported for each country including: size, growth, and structure of population; determinants of population growth (including data on fertility and infant mortality); labour force; education and illiteracy; natural resources; income and poverty; expenditure on food, housing, fuel and power, transport, and communication; and investment in medical care and education. Each of these indicators is broken into several subcategories. Footnotes associated with the printed data are preserved in the hypertext version so that users will be fully aware of significant nuances associated with particular indicators and countries.

TIDE provides brief reports on most of the World Bank's borrowing countries. This compendium complements the World Bank's World Development Report, which looks at major global and regional economic trends and their implications for the future prospects of the developing economies. TIDE digests information from national sources and adds staff commentary to explain recent developments for the benefit of readers who are familiar with macroeconomics but not, perhaps, with every country under review.

For further information, contact: CIESIN User Services/2250 Pierce Road/University Center, MI 48710/USA/Tel: (517) 797-2727/Fax: (517) 797-2622/URL: <**http://www.ciesin.org**>/e-mail: <**ciesin.info@ciesin.org**>. [The work described in this message was generously supported by the National Aeronautics and Space Administration (NASA) under grant NAGW-2901.]

Visit the Ecological Society of America

The Public Affairs Office of the Ecological Society of America has been focusing on specific, major environmental policy decisions currently facing the Congress by using: *The Daily Environment Report*, Bureau of National Affairs Inc., Washington, DC; Congressional Green Sheets, Environmental & Energy Study Institute, Washington, DC.; and *The New York Times*, New York, NY. You can visit their new home page on the WWW (if you have Mosaic, Netscape, or similar program) at <**http://www.sdsc.edu/1/SDSC/Research/Comp_Bio/ESA/ESAHome.html**>.

ICPPGR invites all plant geneticists to participate in its BBN

The Food and Agriculture Organization of the United Nations (FAO) is organizing the Fourth International Technical Conference on Plant Genetic Resources to be held in Leipzig, Germany, 17-23 June 1996. The FAO Secretariat for the International Conference and Programme for Plant Genetic Resources (ICPPGR) will produce the first FAO Report on the State of the World's Plant Genetic Resources and a Global Plan of Action for the Conservation and Sustainable Utilization of Plant Genetic Resources for Food and Agriculture.

To promote the broadest possible participation in this preparatory process, the ICPPGR Secretariat has established a Bulletin Board Network (BBN) to allow interested organizations (international, national, and non-governmental), institutes, universities, research centres, and individuals, at a worldwide level, to contribute actively in this process. The BBN supports the major known communication tools (e-mail, modem to TCP-IP) based on a strong link between a conventional Listserv, a Bulletin Board System (BBS), and a Web server. This BBN will provide discussion groups, access to news, documents, databases, maps, and many other options.

The BBN opened with discussion groups or Conferences on the following topics: *in-situ* conservation/crop improvement; *ex-situ* collections; genetic diversity; plant breeding/improvement; regeneration; and training/education. Other topics will be added in the future.

You are invited to join this BBN, without charge. Here's how to participate:

1) address your e-mail to <**MAILSERV@MAILSERV.FAO.ORG**>;
2) leave the subject line in your header blank;
3) at the beginning of the first line in the body of your mail, type the following command: <***get [icppgr] icppgr-info.txt***> You will then receive an information notice with all the details you need to be connected to the BBN. A newsletter will also be provided regularly, in which you will find all the ICPPGR's informations and activities, and the new options of the BBN.

For more information, contact: ICPPGR, FAO/viale delle Terme di Caracalla/00100 Rome/Italy/Tel: (39-6)52255871/Fax: (39-6)52255533/e-mail: <**ICPPGR@fao.org**>.

Curation Newsletter on the Web

The *Curation Newsletter* of the American Society of Ichthyologists and Herpetologists is available through the WWW at: <**http://muse.bio.cornell.edu/**> and Gopher at: <**gopher://muse.bio.cornell.edu:70/**>. Number 11 of the *Curation Newsletter* contains articles on bis-carbonyl fixatives for museum specimens, the relative merits of isopropanol as a preservative, the MUSE project to design, program, distribute, and support software for the management of natural history specimens, the preservation of color in larval fishes, and the impermanence of laser-printed labels in wet collections, plus announcements and recent literature. [D.E.M.]

Project on Environment, Population, and Security present two new Internet forums

The Project on Environment, Population and Security presents two new Internet-based resources in the field of environment and security. The Document Distribution System and the Discussion Forum provide analysts, scholars, and policy-makers with the opportunity to receive relevant policies, to read scholarly analyses of the impact of renewable resource scarcity, population growth, and migration on civil and regional violence, and to enter into discussions of these issues with colleagues across the country and around the world.

PROJECT OVERVIEW

The project, under the direction of Professor Thomas Homer-Dixon, will gather, evaluate, integrate, and disseminate existing data on causal linkages among population growth, renewable resource scarcities, migration, and violent conflict. The project will gather as much evidence about such linkages as possible; examine and compare the best material to see if common patterns of causation exist across societies, economic regions, and time; and provide accessible summaries of these findings to policy-makers. In this effort, it will be guided by three key questions: 1) What is known about the links among population growth, renewable resource scarcities, migration, and violent conflict?; 2) What can be known about these links?; and 3) What are the critical methodological issues affecting research on these links?

The project is a cooperative effort of the Peace and Conflict Studies Program of the University of Toronto, the Program on Science and International Security of the American Association for the Advancement of Science in Washington, and the Canadian Centre for Global Security in Ottawa.

DOCUMENT DISTRIBUTION SYSTEM (ENVSEC_D)
The initial purpose of the electronic document distribution system is to disseminate documents and announcements produced by the project. The system will also post documents and announcements produced by other projects examining issues related to environment and security. This service is provided free of charge.

To subscribe, send a message (no subject, please) to the following address: **<MAJORDOMO@AAAS.ORG>**. In the body of the message, type the following text: <***subscribe ENVSEC_D "Your e-mail Address"***>. (Substitute your e-mail address for the portion in quotation marks.)

If you are interested in posting a publication or announcement to the document distribution system, send your request for posting to **<PSIS@AAAS.ORG>**, not to **<ENVSEC_D @AAAS.ORG>**. All posted documents will be available through the AAAS Gopher or FTP sites. If you do not have access to Gopher or FTP software, please send publication requests to **<PSIS@AAAS.ORG>**, indicating that you wish to obtain documents that have been posted on the ENVSEC_D mailing list.

DISCUSSION FORUM (ENVSEC_F)
The purpose of this forum is to encourage the discussion of issues related to the environmental dimensions of security. To subscribe, follow the same procedure described above, but type subscribe ENVSEC_F instead of subscribe ENVSEC_D in the appropriate place. If you wish to post a message to the discussion forum, address your message to **<ENVSEC_F@AAAS.ORG>**.

If you have any questions or comments related to the organization or management of this forum, please direct them to the following address: **<PSIS@AAAS.ORG>**. [Dr. Sidney Draggan/Environmental Monitoring and Assessment Program [8205]/U.S. EPA/401 M Street, SW/Washington, DC 20460/USA/e-mail: **<DRAGGAN.SIDNEY@EPAMAIL.EPA.GOV>**.]

Do you want to join an on-line floristic focus group?

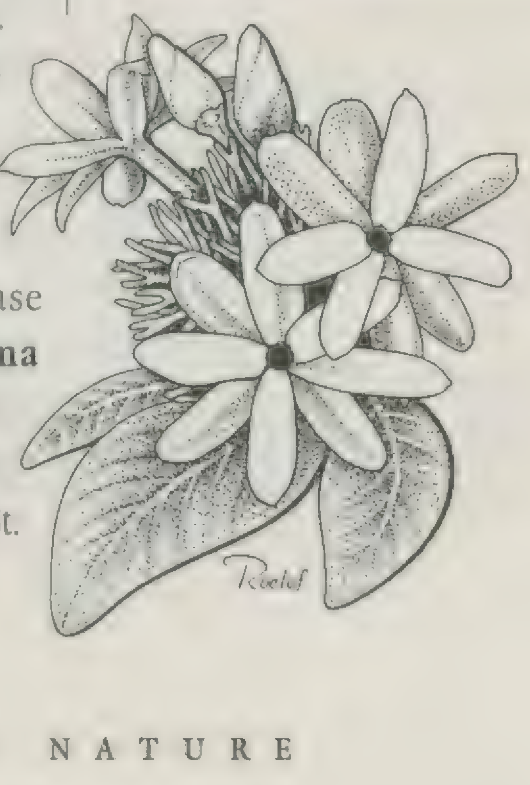
The Electronic Publishing group of Oxford University Press (New York) is soliciting individuals willing to actively participate in an on-line focus group to explore issues regarding on-line availability of floristic information, specifically with regard to OUP's *Flora of North America*, which will be published in electronic form. Oxford University Press would like to begin the moderated discussion soon; all interested individuals should send e-mail to Ursula Bollini: **<uab@oup-usa.org>**. Please include your full name, your professional association, and preferred email address. [Posted to: TAXACOM, BIODICEN-L, BIODIV-L, NHCOLL-L, CONSGIS, BENE. For more information, contact Deborah Leolani Kama, FNA Database Manager by e-mail at **<kama @mobot.org>** or write to Flora of North America Project/Missouri Botanical Garden/P.O. Box 299/St. Louis, MO 63166-0299/USA.

NRDC on the WWW

We are happy to announce that the National Resources Defense Council (NRDC) is now on WWW. To see it, point your browser to **<http://www.nrdc.org/nrdc>**. Special features of our web include:

- "State of Nature," a regular bulletin from the field, focusing initially on the current flood of anti-environmental legislation inspired by the Contract with America.
- Action guidelines on influencing Congress.
- Announcements spotlighting interesting people, events and resources.
- A hotlist of places to visit on the Net.

And that's just for starters. Over the next few months, there are big plans for expansion. There will be action alerts and in-depth briefings on important issues, consumer-oriented facts and FAQs, multimedia clips, and plenty more. We have also started a closed mailing list. Subscribers get "State of Nature" sent to their e-mail addresses. If you're interested, send an e-mail to: **<nrdc-news@nrdc.org>**. (You do not need to include anything in the body of the message.) We welcome your comments about the web or anything else. Please e-mail us at **<nrdcinfo@nrdc.org>** or **<nrdcinfo@aol.com>**.



Biodiversity meetings

MID-FEBRUARY 1996
Capacity Building Conference, to be held in Vancouver, British Columbia, Canada

The conference will work toward building capacity among First Nations to manage natural resources, and will be held in partnership with First Nations, business, and governments.

Contact:
Julian Inglis
Centre for Traditional Knowledge
Box 3443, Station D
Ottawa, Ontario K1P 6P4
Canada
Tel: (613) 566-4750
Fax: (613) 952-9693
e-mail: <**jlinglis@magi.com**>

21-22 FEBRUARY 1996
Plant Life Histories: Ecological Correlates and Phylogenetic Constraints, to be held in London, U.K.

Contact:
The Scientific Meetings Secretary
The Royal Society
6 Carlton House Terrace
London SW1Y 5AG
UK

18-19 MARCH 1996
International Sustainable Development Research Conference, to be held in Manchester, U.K.

Contact:
Conference Manager
ERP Environment
P.O. Box 75
Shipley, West Yorkshire BD17 6EZ
UK
Tel/Fax: 44 1274 530408

24-27 MARCH 1996
Workshop on Disseminating Biodiversity Information, to be held in Amsterdam, The Netherlands.

Topics include: collections and taxonomic databases, accessibility, data management, standardizaton, and legal and ethical issues.

Contact:
Conference Office
University of Amsterdam
Spui 21
NL-1012 WX Amsterdam
The Netherlands
Tel: +31.20.525.2690
Fax: +31.525.4755
e-mail: <**congress@bdu.uva.nl**>

26 MARCH 1996
International Wildlife Law: Preserving Biodiversity in the 21st Century, to be held in Washington, D.C.

This one day conference will focus on the current and prospective efficacy of international wildlife treaty regimes, including CITES, the ICRW and several marine conservation conventions.

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Wil Burns
Director
Pacific Center for International Studies
33 University Square, Ste. 184
Madison, WI 53715
USA
Tel/Fax: (608) 256-6312
e-mail: **<pcis@igc.apc.org>**

26-29 MARCH 1996

Globe 96, to be held in Vancouver, British Columbia, Canada

This conference will focus on developing the business of the environment and offers a networking opportunity for the corporate sector, environment industry and financial community.

Contact:
GLOBE Foundation of Canada
World Trade Centre
504-999 Canada Place
Vancouver, BC V6C 3E1
Canada
Tel: (604) 775-1994
Fax: (604) 666-8123

19-21 APRIL 1996

Waterbirds, Wetlands and Recreation: Putting Sustainability into Practice, to be held in Bristol, UK.

Contact:
Graeme Greene
British Ornithologists Union
c/o British Museum (Natural History)
Sub-department of Ornithology
Tring, Hertfordshire HP23 6AP
UK

26-27 APRIL 1996

Environmental Cultures: Historical perspectives, to be held in Victoria, British Columbia, Canada.

This is a call for papers for this interdisciplinary conference on the relationships between environment and culture. The organizers hope to foster a meeting of social, political, and ecological analysis.

Contact:
Dr. Lorne Hammond or
Dr. Richard Rajala
Environmental Cultures Conference
Department of History
University of Victoria
P.O. Box 3045
Victoria, B.C. V8W 3P4
Canada
Tel: (604) 721-7382
Fax: (604) 721-8772
e-mail: **<lhammond@sol.uvic.ca>**

16-17 MAY 1996

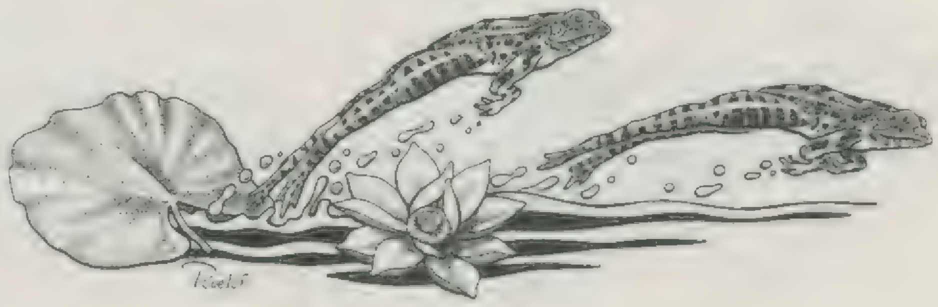
23rd Annual Conference on Ecosystems Restoration and Creation, to be held in Plant City, Florida, USA.

Contact:
Frederick J. Webb
Dean of Environmental Programs
Hillsborough Community College
Plant City Campus
1206 N. Park Rd.
Plant City, FL 33566
USA
Tel: (813) 757-2104

19-22 MAY 1996

Global Genetic Resources - Access, Ownership, and Intellectual Property Rights, a Beltsville Agricultural Research Centre Symposium and Association of Systematics Collections Meeting, to be held in Beltsville, MD, USA.

Contact:
Amy Rossman
USDA / SBML,
Bldg. 011A, Rm. 304
BARC
Beltsville, MD 20705
USA
Tel: (301) 504-5364
Fax: (301) 504-5810



25-30 MAY 1996
Ecological and Evolutionary Ethology of Fishes, to be held in Albuquerque, New Mexico, USA.

Contact:
Astrid Kodric-Brown
Department of Biology
University of New Mexico
Albuquerque, NM 87131
USA

13-19 JUNE 1996
76th Annual Meeting of the American Society of Ichthyologists and Herpetologists and 20th Annual Larval Fish Conference, to be held in New Orleans, Louisiana, USA.

Contact:
Richard F. Shaw
Director, Coastal Fisheries Institute
Louisiana State University
Baton Rouge, LA 708-7503
USA
Tel: (504) 388-6455
Fax: (504) 388-6513

24-27 JUNE 1996
Second International Airborne Remote Sensing Conference and Exhibition: Technology, Measurements and Analysis, to be held at NASA Ames Research Center's Moffett Federal Airfield in Mountain View, California, USA.

Contact:
Robert Rogers, ERIM Conferences
Box 134001
Ann Arbor, MI 48113-4001
USA
Tel: (313) 994-1200, ext. 3234
Fax: (313) 994-5123
e-mail: **<raeder@erim.org>**

9-13 SEPTEMBER 1996
Integrating Conservation of Biological Diversity with Social and Economic Goals, an international conference to be held in Victoria, British Columbia, Canada.

Proposed discussion topics include Setting the Global Stage: Updates on National and International Issues; Understanding Principles and Concepts of Ecoystems, Human Values, and What to Sustain; and Managing Sustainability at Regional and Local Scales: Examples of Solutions.

Contact:
Conference Secretariat
Connections Victoria Ltd.
P.O. Box 40046
Victoria, B.C. V8W 3N3
Canada
Tel: (604) 382-0332
Fax: (604) 382-2076

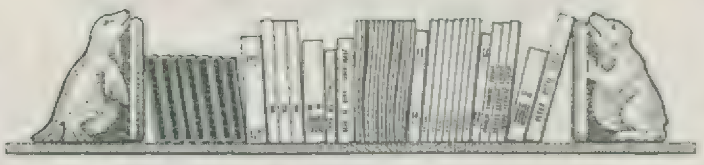
13-23 OCTOBER 1996
Caring for the Earth, the IUCN World Conservation Congress, to be held in Montreal, Quebec, Canada.

Over 2,000 participants will attend from over 130 countries, bringing together the world's foremost conservation scientists and practioners, politicians and business leaders to debate global environment and development issues with a view to fostering a sustainable use of resources.

Contact:
IUCN World Conservation Congress
Canadian Heritage, Parks Canada
Guy-Favreau Complex
200 Rene-Levesque Blvd. West
West Tower, 6th floor
Montreal, Quebec H2Z 1X4
Canada
Tel: (514) 496-5387
Fax: (514) 283-2015
e-mail: **<congres_uicn@pch.gc.ca>**

20-26 JULY 1997
International Symposium on Phylogeny and Classification of Neotropical Fishes, to be held at Museu de Ciencias e Technologia, Pontificia Universidade Catolica do Rio Grande do Sul, Porto Alegre - RS - Brazil.

Contact:
Luiz R. Malabarba (Chair)
Museu de Ciencias et Technologia - PUCRS
Av. Ipiranga 6681 Cx.P. 1429
90619-900 Porto Alegre RS
Brazil
Tel: Porto Alegre (051) 339-1511 ext. 3138
Washington (202) 357-4027
Fax: Porto Alegre (051) 339-1564



Book and Periodical Niche

Biological diversity—the coexistence of species on changing landscapes

By Michael A. Huston. 1994. Cambridge University Press, Cambridge, Massachussetts. xix + 681 pp.; illus.; index. Paperback, ISBN 0-521-369300-4. US$34.95.

Biodiversity has recently become a buzzword, used not only by bioscientists, but also by a vast array of other professionals from environmentalists with an axe to grind to artists grasping for contemporary relevance. This extensive use of the term is covering up a woeful lack of precision, even of general understanding of what biological diversity is. Several recent attractively produced books on the topic have failed to anchor the concept firmly in the realm of bioscience. Pretty pictures, flowery language, and examples of loss of endangered species may sell the need for conservation to an already keen public, but do little to further our understanding of the ecological concepts and problems involved.

Huston's book attempts to rectify this situation valiantly and somewhat successfully. It provides an immense amount of information not only on biological diversity, but on the much broader discipline of community ecology in general. (The reference section contains more than 2,000 references!) In fact, this book is close to being a general ecology text as well as a treatise on biological diversity. However, while Huston is very successful in firmly placing the diversity concept in the science of ecology, in a way he overdoes this. At times the reader is left wondering what the relevance of certain sections is to the main theme. For instance, the detailed discussion of the long history of succession theory on p. 237 is unnecessary.

The book is divided into four parts. Part One deals with "Raw Materials and Tools," Part Two with "Theories of Species Diversity," Part Three with "Mechanisms that Regulate Diversity at Various Spatial and Temporal Scales," and Part Four provides a number of case studies.

It is a shame that Huston strongly advocates a certain set of theories while ignoring others; this is especially worrisome since his theoretical arguments are frequently wanting in depth and precision. This gives the impression that he is trying to convince the reader of some theory or other without providing all the evidence. For example, his strong emphasis on the importance (or lack thereof) of competition theory is carried too far. The simple Lotka-Volterra competition theory is obviously not of much relevance; there is a lot more to competition, which can be quite fierce well below the carrying capacities of the competing species. On the other hand, I feel that Huston pays insufficient attention to the concepts of co-evolution and resultant species packing. Part Four, which is nearly half the book, has four excellent chapters dealing with endemism and invasions, marine ecosystems, fire-influenced systems, and tropical rain forests. These chapters are very readable, and full of extensively referenced and well-structured information.

This book will function well both as a textbook for advanced undergraduate or graduate students and a valuable reference work for teachers or practicing ecologists. Its theoretical weakness and one-sidedness can be minimized by placing it in a broader reading context of other recently published work. Huston has provided us with an important book that will introduce the concepts of biological diversity to the upcoming generation of young ecologists, and help teachers and researchers with ideas, examples, and references.

R. Harmsen, Professor of Biology, Queen's University, Kingston, Ontario

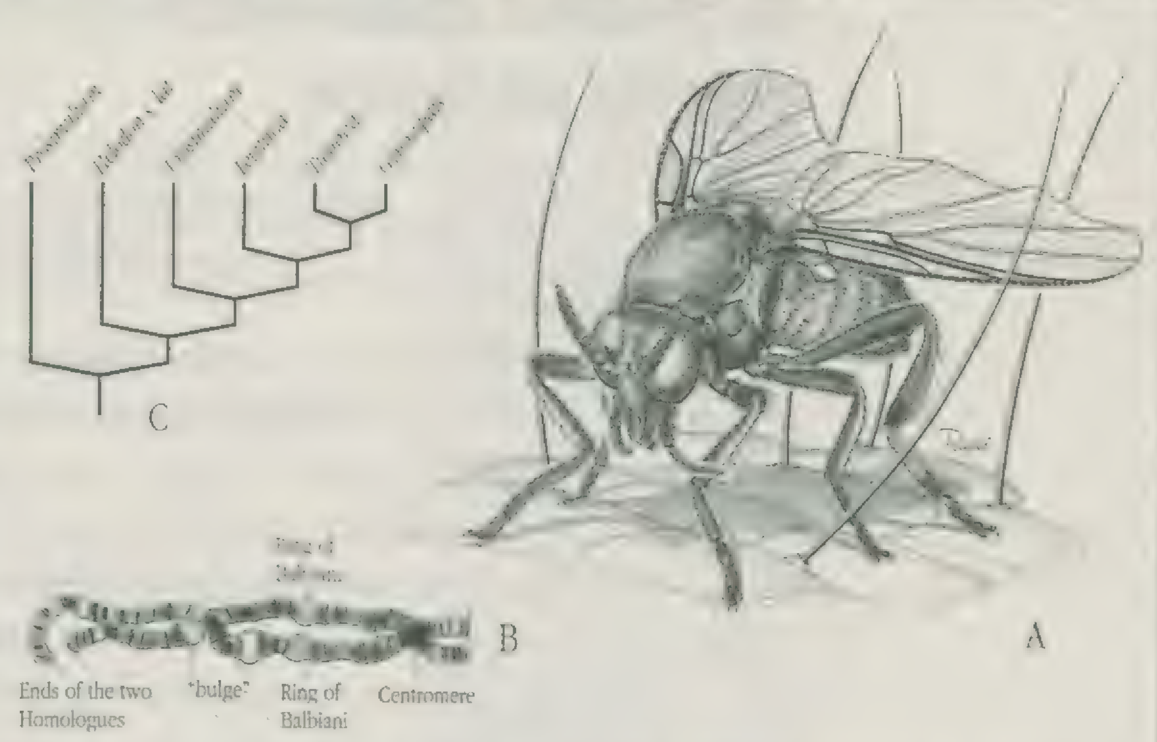
Interpreting the hierarchy of nature: From systematic patterns to evolutionary process theories

Edited by Lance Grande and Olivier Rieppel. 1994. Academic Press, San Diego, California. viii + 298 pp. ISBN 0-12-295120-4, US$59.95.

Scientifically, issues in biodiversity or environmental conservation rest on sound biosystematics. Like any active field of research, this discipline has at any moment "hot" areas of dispute, and this volume usefully profiles the current "hot" areas. The chapters, based on presentations at the Field Museum in Chicago, present various viewpoints on macro-evolutionary subjects involving the formation and interpretation of hierarchies and temporal sequences; types of data from morphology, fossils, and molecules; and operational principles, such as the formation of cladograms. Compositionally, the print size and page margins are generous, and there is a subject index and glossary.

The first two chapters are primarily philosophical. R. Brady perceptively examines the historical relationships of morphology as a descriptive science with theoretical components of evolutionary biology in terms of homologies, transformations, and Whig interpretations, particularly those intepretations by Thomas Huxley. J. Beatty argues that a theoretical pluralism, with multiple and reciprocal interpretations, is needed because a theoretical unity is too constraining, but he is correct to acknowledge that many will demur.

Other chapters include a case study from paleoichthyology in which L. Grande well discusses the importance of character congruence and repeating patterns and their impact, via theoretical interpretation, for linking phylogenetics and evolutionary theory. Drawing on the controversy of bat phylogeny, M. Novacek provides an excellent overview of the roles of molecular and morphological data. D. Fisher persuasively urges the use of stratigraphy for temporal issues in evolutionary biology and, together with biogeographic data, for selecting among cladograms. For understanding phylogenetic patterns and processes, M. Wake is usefully provocative in her advocacy of unconventional characters such as neuroanatomy and sperm structure. N. Chubin offers insights into the phylogeny of development, with conceptual aspects of homology, the role of ontogenetic data, and illustrations with avian digits.



A. Shown here is the adult female of *Simulium tuberosum*, showing the external taxonomic features that help distinguish it from over 260 other black fly species in North America. These readily visible taxonomic differences are used to identify and classify insects and other life forms, but are not always sufficient. Therefore, scientists look deeper to the cytotaxonomy of their chromosones.

B. Shown here is the chromosone IIS from the larval salivary gland of a male *Simulium tuberosum*, which is unique to the males of this species.

C. The diagram is an example of a simple phylogeny, used by taxonomists to represent a hypothesis of relationships among taxa.

(Special thanks to Peter H. Adler, Clemson University, South Carolina, Doug Currie of the Royal Ontario Museum, and the Canadian National Collection of Insects housed at the Biological Resources Division of Agriculture and Agri-Food Canada)

Taken together the presentations illuminate many conceptual (i.e. structuralism) and procedural (i.e. parsimony) topics. With a conscientiousness, unfortunately sometimes lacking in volumes of contributed chapters, the editors have commendably taken pains to stress the key theme of the search for order in nature on the basis of congruence. They have also synthesized and criticized candidly and carefully the material in both an Introduction and a Summary and Comments. This conscientiousness is also reflected in the glossary, which will doubtless help some readers, although any who need it extensively will be unable to comprehend the advanced text. The glossary itself is uneven in some respects, with some entries being unnecessary (and Karl Popper becoming Pauper: a mid-western accent?). Overall, however, this book provides a valuable update on central issues in biosystematics that underpins so many green controversies.

Patrick Colgan, Executive Vice-President, Canadian Museum of Nature, Ottawa, Ontario

The greening of Canada: Federal institutions and decisions

By G. Bruce Doern and Thomas Conway. 1994. University of Toronto Press, Toronto, Ontario. 297 pp. ISBN 0-8020-0645-0. $50.00 (hardcover); $19.95 (paper).

The slow development of environmental regulation and legislation has annoyed and frustrated environmentalists over the last 20 years. This book explains why the process takes so long. It is a very readable account of the 20-year evolution of Environment Canada from its inception in the early 1970s. It discusses the development of environmental policies and legislation and the enormous hurdles that had to be overcome in a climate of competing departmental mandates and changing political priorities.

A reader from outside the government will find the story quite convincing. Someone who has been directly involved in government will have reservations. For example, the story rarely mentions that other departments provide strong support for environmental policy development, and where appropriate, take environmental initiatives within their own departments. Sometimes, in fact, more progress is made outside Environment Canada than inside.

A case in point involves the pulp-and-paper industry (which the authors use as the standard "bad guys" throughout their text) and Industry Canada, a department that is often perceived as the environmental redneck of government. Environment Canada's attempt to impose AOX-based effluent regulations on the pulp-and-paper mills was opposed by Industry Canada, and ultimately, derailed by scientific information developed in Environment Canada's own laboratories. Further development of that research, directed by Environment Canada scientists, was supported by about $3 million from the Forest Industries Research and Development (R&D) and Innovation Program of Industry Canada. Subsequently, Industry Canada developed a government-industry agreement, signed in March 1994 by the industry and the Ministers of Environment and Science, which calls for the eventual implementation of closed-cycle systems in Canadian mills. Such a move would not only eliminate the pollution but also the regulatory conflicts between government and industry.

Information in a recent study can be used to emphasize the relative importance of other departments in supporting environmental R&D. In 1993-94, $27.34 million of grant funding from governments in Canada supported research in pulp and paper in Canada. Industry Canada contributed $12.82 million while Environment Canada contributed less than $100,000. At least a third of these funds was spent on environmental research.

Industry Canada does not deserve all of the credit. The book refers to Environment Canada's role in supporting the Save the Skagit Committee's activities. This is true. However, the Opportunities for Youth Program of Employment and Immigration, not Environment Canada, provided the initial funding to pay for the preparation of the report "The Future of the Skagit Valley" that was presented to the International Joint Commission in 1971. Such efforts elsewhere in government parallel and support Environment Canada, and a more complete reference to them would have provided a more balanced account.

A further point on the pulp-and-paper initiative is that the book makes reference to sustainable development and states that "This is not really happening." The millions of dollars that have been poured into pulp-and-paper environmental research and the aggressive initiatives being undertaken by the industry to implement changes to their mills are making far greater strides towards the goals of sustainability than the authors and the public appreciates. The authors identify two regulation policy choices in this field: 1) end-of-pipe treatment; or 2) regulation based on assessing the capacity of the receiving water. The adoption of closed-cycle systems (mentioned above) by both the pulp-and-paper and chemical industries indicate that they are well on their way to the third choice—zero discharge—which establishes a base for sustainable development.

One excellent point that comes through is the role scientists and engineers play in the development of environmental policies and regulations. The *raison d'être* of Environment Canada must be the scientific research laboratories that provide accurate, factual information on the state of the environment and the impact of pollutants. If the science is done well, then reasonable regulations and legislation, whether provincial or federal, can be developed successfully. Furthermore, regulations based on accurate science will be more readily accepted by industry.

Unfortunately, as the book implies, the department has a tradition of keeping its scientists down in the trenches.

Very few ever reach senior executive positions where the ultimate decisions are made, and policy is perceived as the exclusive domain of economists. Witness the transfer of a significant number of the National Energy Program (NEP) economists to Environment Canada under Len Good when he became Deputy Minister. As the Green Plan unfolded, it was led by the new Assistant Deputy Minister of Policy, Brian Emmett, who admitted that he had no knowledge of the environment. One must question the logic of a central agency that says economists should develop national policy on a scientific subject. Would they turn over the development of economic and fiscal policy to the scientists? As a nation, we need the best scientific research and scientifically knowledgeable decision-makers at the top.

Referring again to the NEP, the book states that there are certain references to the environment in the NEP but that these were not followed up with funding at the implementation stage. This is open to debate. I suggest that the $500 million a year, which supported energy conservation and renewable energy, along with the 350 people who worked in that branch of Energy, Mines and Resources (and who were supported by 3,000 more people across the country funded by FLIP, the Federal Local Initiative Program) were directly working on environmental policy and programs. I know that the vast majority of those individuals saw themselves as environmentalists. In fact, at that time, the whole of the energy conservation initiative at Energy, Mines and Resources was led by an ecologist who had chosen to take a position in that department, rather than one offered in Environment Canada, in order to establish a "second front" in support of the environment.

It is a pity that the authors did not pay any attention to the personalities of the various players, because anyone with experience in policy development will know that individuals make or break any initiatives. Strong leaders are the key to success and individual traits are important in understanding why some succeed and others do not. The book identifies some individuals—Jack Davis, John Fraser, Blair Seaborn, Tom MacMillan, Elizabeth May, Bob Slater—as key players. But why were they important and influential? Why, for example, has Bob Slater survived for years as an Assistant Deputy Minister and been so influential while his associates have come and gone? I would like to have seen a greater accounting of how policy is really developed rather than the political science of policy development.

Another question that is skated over by the authors is the role of environmental NGOs in environmental policy development. Over the last 20 years, they have used well-choreographed publicity campaigns to usurp the rights of the politicians to develop priorities and initiatives. In many cases their views have not reflected the will of the majority and frequently were not based on factual information. Surely, any political science account of environmental policy should analyze this point, since it is the one that separates normal policy development from environmental policy.

To a large extent, the points raised in this review are ones of omission rather than criticism of the content itself. If you are interested in what goes on in Ottawa, reading this book will help you understand the complexities and the continuous balancing of power that underlies government. You may well remain frustrated, but at least you will now know why!

Ian E. Efford, President, Avocet International, 1909 Broadmoor Avenue, Ottawa, Ontario, Canada K1H 5B3

IUCN Red List categories

Prepared by the IUCN Species Survival Commission as approved by the 40th Meeting of the IUCN Council. IUCN, Gland, Switzerland, 30 November 1994. 21 pp.

The IUCN Red List is one of the most widely used and respected guides to species at risk around the world. Since the categories of species at risk have been in place for almost 30 years, it was felt that there was a need to revise them. The proposed definitions were arrived at through a continuing process of drafting, consultation, and validation. This document proposes new definitions with the following aims:

- to provide a system that can be applied consistently by different people;
- to improve the objectivity by providing clear guidance on how to evaluate the different factors that affect risk of extinction;
- to provide a system that will facilitate comparisons across widely different taxa;
- to give people a better understanding of how individual species are classified.

The preamble to the definitions discusses: taxonomic level and scope of the categorization process; nature of the categories; role of the different criteria; derivation of quantitative criteria; implications of listing; data quality and the importance of inference and projection; uncertainty; conservation actions in the listing process; documentation; threats and priorities; use at the regional level; re-evaluation; transfer between categories and problems of scale. Various terms used in the definitions are then explained.

Definitions are included for the following words and prhases: Extinct; Extinct in the Wild; Critically Endangered; Endangered; Vulnerable; Lower Risk (with subcategories Conservation Dependent, Near Threatened, and Least Concern); Data Deficient; and Not Evaluated. The new definitions and criteria are much sounder and more firmly established than those previously used. These definitions are followed by criteria for the species labelled Critically Endangered, Endangered, and Vulnerable.

Those interested in conservation of species at risk should carefully read the *IUCN Red List Categories.* Whenever possible, legal instruments, such as treaties and conventions, governments, and international, regional, and local conservation organizations, should adopt the new definitions. Conservation is furthered by having a universally accepted, carefully defined set of terms. Loose and differing usage harms conservation. For an application of IUCN categories, see the review below of *Birds to watch 2.* *[D.E.M.]*

Birds to watch 2: The world list of threatened birds

By N.J. Collar, M.J. Crosby, and A.J. Stattersfield. 1994. BirdLife Conservation Series No. 4. BirdLife International, Wellbrook Court, Girton Road, Cambridge, CB3 0NA, UK. 407 pp. Softcover, ISBN 0-946888-30-2, UK £18.50.

In this new and completely revised edition, which uses the latest IUCN criteria, about 1,200 bird species have been identified as threatened on a global scale, and details on their distribution, habitat requirements, and population numbers and trends are given.

The book provides an overview of the new IUCN criteria for assigning threat status and categories, and a brief discussion of general trends and factors in the global endangerment of birds. The bulk of *Birds to watch 2* consists of information about globally threatened species and a listing of near-threatened species, both organized by family. The appendices reorganize these species according to geopolitical units and threat levels, and rank the geopolitical units by number of threatened birds. An extensive bibliography and index of species complete the volume. *[D.E.M.]*

Biodiversity conservation: Forests, wetlands and deserts

Proceedings of the Indo-British Workshops on Biodiversity, February 1993, New Delhi. Edited by B. Frame, J. Victor, and Y. Joshi. 1993. Tata Energy Research Institute, 101 Jor Bagh, New Delhi, India. 153 pp. Hardcover, ISBN 81-85419-03-5, US$42.00.

This book is exactly what the sub-title states: a synopsis of workshops held in New Delhi after visitations to certain sites in the field. And once again it points out that India is suffering from the same problem many countries are suffering—destruction of biodiversity due, in main part, to anthropogenic causes. Of course, a major reason for such destruction is the population increase that has attended India for so long. Coupled with this is the spill-over of mankind into areas of the country that were previously undisturbed, resulting in loss of ecosystems. The complaints and solutions offered to India's problems have been echoed throughout the world before. Unless these problems are addressed through political will and population control, the loss of biodiversity in India, and in many other countries on the Asian continent, will progress at an ever-increasing speed.

If one is interested specifically in the Indo-British viewpoint on biodiversity in India, then this book contributes a little towards understanding the problems. From any other aspect, it only reiterates what other countries already know—all continents and ecosystems are in trouble; it offers no solutions except further studies, which is the common rhetoric of the day whether it be in India or Canada.

John Ditchfield, 706-125 McLeod Street, Ottawa, Ontario K2P 2C7

The choice: Evolution or extinction? A thinking person's guide to global issues

By Ervin Laszlo. 1994. G.P. Putnam's Sons, New York. 224 pp. Hardcover, ISBN 0-87477-753-4. US$23.50.

It is difficult to imagine how any thoughtful and reasonably well-informed individual today could dispute the following proposition: Collectively, human beings must either radically change the way they organize and run their affairs so that their impact on the biosphere is curtailed or else risk perishing as a species. It is even more difficult to imagine after reading Ervin Laszlo's *The Choice*, which mercilessly hammers home this point. He is, of course, neither the first author nor will he be the last to wade into this genre, and Laszlo, a highly experienced futurist and a seasoned writer, skillfully avoids the pitfalls of sounding hackneyed, like a fear-mongerer, sensationalistic, and not credible for these or other reasons. His thesis, simply stated, is this: "Our generation, of all generations in history, is called upon to decide the destiny of life in this corner of the universe. The choice is ours: evolution or extinction." (p. 194).

Laszlo reviews recent historical, political, economic, and technological trends, surveys the damage humans have done to nature, and in Chapter 3, offers "a short catalogue of obsolete beliefs and misguided practices" governing human life at present. The list includes beliefs, such as: efficiency is maximum productivity; facts count, values don't; the wealth and power of one's own country is the ultimate aim; nature can look after itself; fecundity equals virility. In Chapter 4, he argues that humans need to acquire a new "evolutionary literacy"—an understanding of the new technologies, the information revolution, and how humans and systems evolve—so that they can adapt to and control these developments rather than be controlled by them. Laszlo presents a summary of areas or case studies wherein action is urgently needed in order to avert global crises of various sorts. The most interesting of these is found in Chapter 9, entitled "An Agenda for World Order." Here Laszlo argues persuasively that a "functional world order" is the only alternative to the eventual complete breakdown of order and government in have-not countries and the subsequent massive migrations that European, North American, and Asian-Pacific nations will be powerless to prevent.

Readers who are looking for practical advice on how to empower themselves and contribute to the solution of global problems will find little other than platitudes, such as "think globally," "act morally," and "live responsibly" (Chapter 7). Nor is there much here for those interested in the topic of global biodiversity. Biodiversity is only mentioned three times in the text (and not at all in the index) merely to flag it as an aspect of the Earth's health that is under threat, but no new insights are offered. Although there is a bibliography (mostly of books on systems theory), documentation of Laszlo's claims is completely lacking, as is the case in so many popular books of this sort. Notwithstanding these problems, *The Choice* is valuable and easy to read.

Michael Allen Fox, Department of Philosophy, Queen's University, Kingston, Ontario

Environmental regulation, jobs and U.S. competitiveness: What's the real issue?

By Robert Repetto. World Resources Institute, Baltimore, Maryland. Est. 40 pp. Large-format paperback, ISBN 1-56973-030-X, US$12.95. Order from: WRI Publications, P.O. Box 4852, Hampden Station, Baltimore, MD 21211 or call 1-800-822-0504.

The U.S. economy has improved in recent years—employment and productivity are up, federal deficits are down, and economic growth is relatively strong. But environmental progress is at a standstill. Many businessmen, labour unionists, politicians, and ordinary citizens fear that America can't afford stronger environmental protection, that regulatory burdens are undermining the U.S. competitive position abroad, destroying jobs at home, and dragging down productivity and growth. With careful analysis and a large body of empirical evidence, Dr. Repetto shows that stringent environmental regulations do not result in lost jobs or put the U.S. at a competitive disadvantage with foreign countries having weaker regulations. [Publisher's summary].

Eyes in the sky

The Greenhouse Effect Detection Experiment. Selected data sets on CD-ROM. By L. M. Olson and A. Warnock, III. 1992. NASA Goddard Space Flight Center, Greenbelt, Maryland. Two compact disks. (Free of charge and can be ordered through the Web at <**http://daac.gsfc.nasa.gov/**> and *Atlas of Satellite Observations Related to Global Change.* Edited by R.J. Gurney, J.L. Foster, and C.L. Parkinson. 1993. Cambridge University Press, Cambridge, Massachusetts. xiv + 470 pp. ISBN 0-521-43467-X, US $49.94

[Climate warming represents one of the greatest threats to biodiversity, and some impacts such as coral reef bleaching have already been detected. Satellite temperature data has two advantages—standardized temperature measurement and even geographic sampling, even in those areas lacking in weatherstations, such as

inland wildernesses and remote ocean areas. It is, therefore, interesting to read "Eyes in the Sky," Dr. Scheuler's review on two new sources of satellite data. The CD-ROMs have become especially valuable as National Oceangraphic and Atmospheric Administration web sites with satellite data are being threatened with closure. (D.E.M.)]

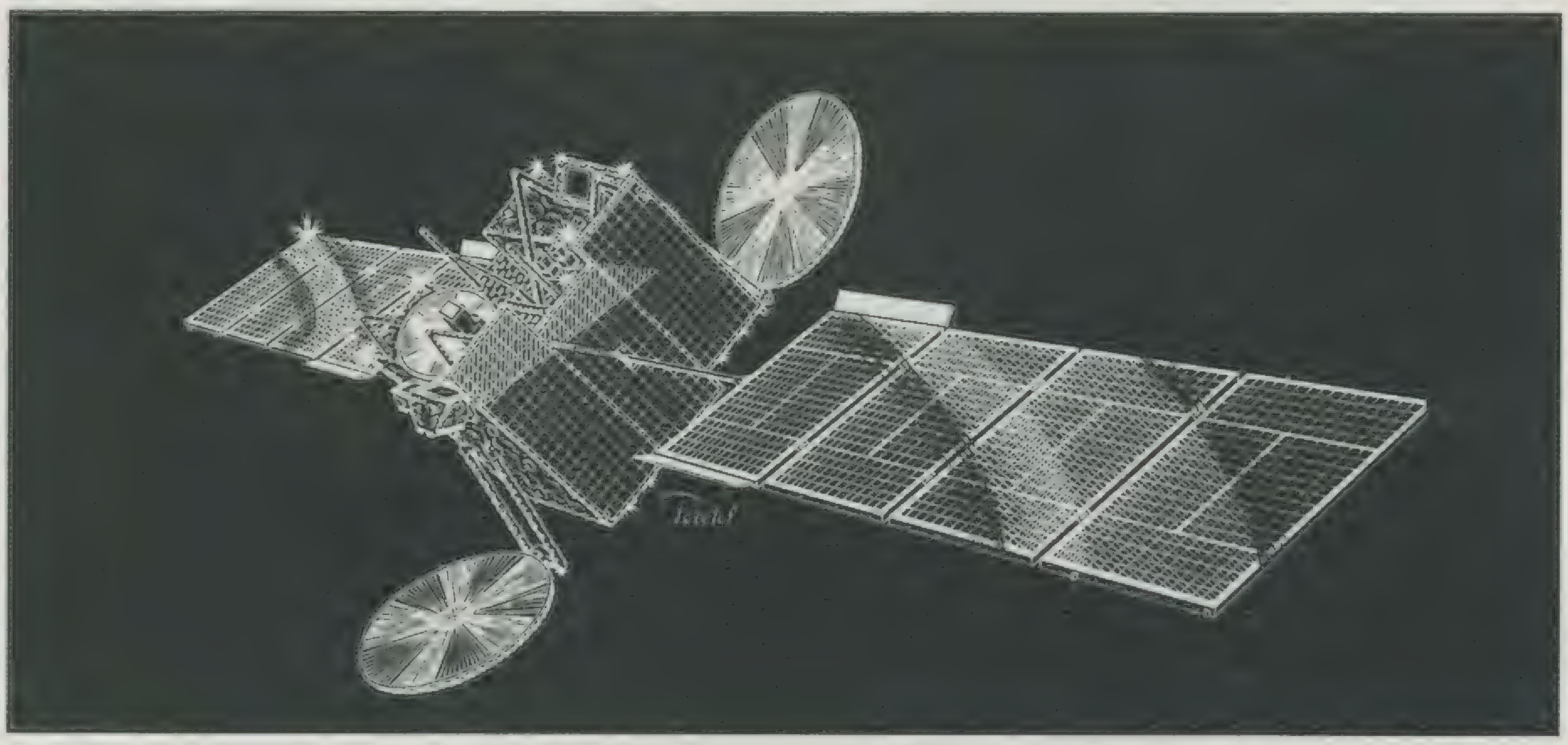
Satellites have been measuring electromagnetic emissions of the Earth for three decades, but many potential data users do not know what has been measured or how to obtain the data. Together, this book and computer CD-ROM disk set have done a great deal to solve this problem for me.

The data distributed on the CD-ROMs were selected at the Greenhouse Effect Detection Experiment (GEDEX) Workshop in 1991 for their relevance to studies of global warming; the disks were produced by NASA's Climate Data System. The first disk holds 372 megabytes of temperature, solar irradiance, cloud and radiation budget data, and the second, 563 megabytes of atmospheric constituent data. Some surface data cover more than 100 years, while most of the satellite-derived data cover only 1978-1989. Temporal resolution is usually monthly.

A CD-ROM is like a diskette in any other computer drive with one exception: the disk is not erasable. Each data set is accompanied by a short summary and a detailed description of the data with literature references and addresses of people to contact for further information. The data are output to ASCII computer files in a uniform "common data" format by an interface designed to resemble NASA's on-line system. The data are clumsily menu-driven, but able to run on many operating systems. The CD-ROM has the advantage of holding large quantities of data, up to 600 megabytes per disk.

When I tried to use the sea surface temperature data to calculate monthly averages for a system of equal area biogeographic cells, it was unclear whether the geographic coordinates of 2-degree cells referred to the centre or one corner of the cells. I used the addresses in the documentation to learn that cell centres were denoted, so that "For grid cells located at -90 or 90 degrees of latitude they can be thought of as grid cells that lay across 1 degree of the globe with the rest overlapping space" (Frank Corprew, in litt., 1 April 1994). The North Pole is, therefore, crowded by 180 of these non-Euclidean cells.

The *Atlas of Satellite Observations Related to Global Change* is an introduction to the whole range of satellite data, with summaries of how they were obtained and where they are available. The GEDEX disks are not mentioned. There are hundreds of vibrant false-colour maps in a variety of projections, mostly at the scale of across-the-page:around-the-world, printed on coated, acid-free paper. Scale bars on many maps show two or more stretches of similar colours separated by black, which must be effective on a full-screen display, but is confusing at the scale of the maps in the book. I am in no position to pick out technical errors, but on p. 95, degrees Celsius are used for degrees Kelvin; the Tibetian Plateau is mis-located in "south-western China" (p. 346), doubtless to the delight of the occupying Chinese forces; and Northern Hemisphere season names are used a few times for the Southern Hemisphere.



Anik E2 satellite, owned and operated by Telesat Canada. (Drawing based on photos provided by Telesat Canada.)

The chapters are uniform in tone and style: Introduction, Methodology, Analysis & Results, Limitations, Applications, and Availability of Data. My one disappointment, as an Earth-bound naturalist, was that there was no description or illustrations of what the sensors look like or how they operate. There is much discussion of the calibration of the sensors measuring slight decade-long trends in millions of individual measurements of solar irradiance, the radiation budget at the top of the atmosphere, and stratospheric chemistry and dynamics. Stratospheric aerosols, atmospheric temperature, and water vapour show marked yearly fluctuations. Lightning is the only natural phenomenon observed directly. Clouds, tropospheric chemistry, terrestrial vegetation, sea surface temperature, snow cover, and sea ice are measured by comparisons of reflectances and emissions at different wavelengths. Marine productivity is estimated by a complex model of the faint green signature of chlorophyll glinting up through the surface. Ground-level data of oceanic evaporation, ocean winds, and precipitation calibrate satellite measurements of surprisingly indirect radiative effects in global models.

Topography of land and sea is measured by radar, allowing calculation of oceanic circulation. Ice sheets, glaciers, and volcanoes can be viewed at coarse scales, or in detailed LANDSAT images, which are often too expensive for researchers to obtain. Topics treated separately are the El Nino Southern Oscillation, coastal change, desertification, stratospheric ozone depletion, and indications and effects of human activities.

Decades of numerically scanning the entire globe from high-tech Apollonian chariots have not made the authors into "Deep Ecologists," and gratingly, managerial attitudes crop up in many chapters. When it is noted, for example, that "a well-managed land will recover from droughts with minimal alteration when rain returns" (p. 314), the reader is left to infer that wilderness is the best land management. Narrow-wavelength technology has an awe-inspiring ability to suck data indiscriminately out of wild lands, high seas, and regions abused by their human occupants. But can it suppress abuse, or will it just try to tell abusers how far they can push Nature before it breaks?

Frederick W. Schueler, Bishops Mills, RR #2, Oxford Station, Ontario K0G 1T0

The global environmental crisis: Implications for social welfare and social work

Edited by Marie D. Hoff and John G. McNutt. 1994. Ashgate Publishing Co., Brookfield, Vermont. Cloth, ISBN 1-85628-585-5, $88.00.

This edited volume by social welfare scholars demonstrates the convergence between social and environmental problems and policies. Contributors explore the way environmental concerns challenge prevailing political and economic theories and practices, which drive conceptions of social welfare. They document the environmental factors in social issues such as health problems, unemployment, racism, and consumerism. The implications of environmental issues for social research, planning and policy development, as well as for therapeutic practice and community organization methodology, are also discussed. *[Condensed from Publisher]*

Perspectives towards sustainable environmental development

Edited by Colin C. Williams and Graham Haughton. 1994. Ashgate Publishing Co. Brookfield, Vermont. 224 pp. Cloth, ISBN 1-85628-874-9, $82.00.

This book's theme is explored from four contrasting perspectives. Part I, Economic Perspectives, covers the approaches of both the old orthodox economics and the new economics. Part II, Business Perspectives, reviews relationships between business, particular industrial sectors, and the environment. Part III, Planning Perspectives, examines planning at scales ranging from the global and international through the urban scale to the local level. Part IV, Political Perspectives, covers contemporary debates in environmental politics as well as the broader politics of sustainable development. *[Condensed from Publisher]*

Cost-benefit analysis and the environment

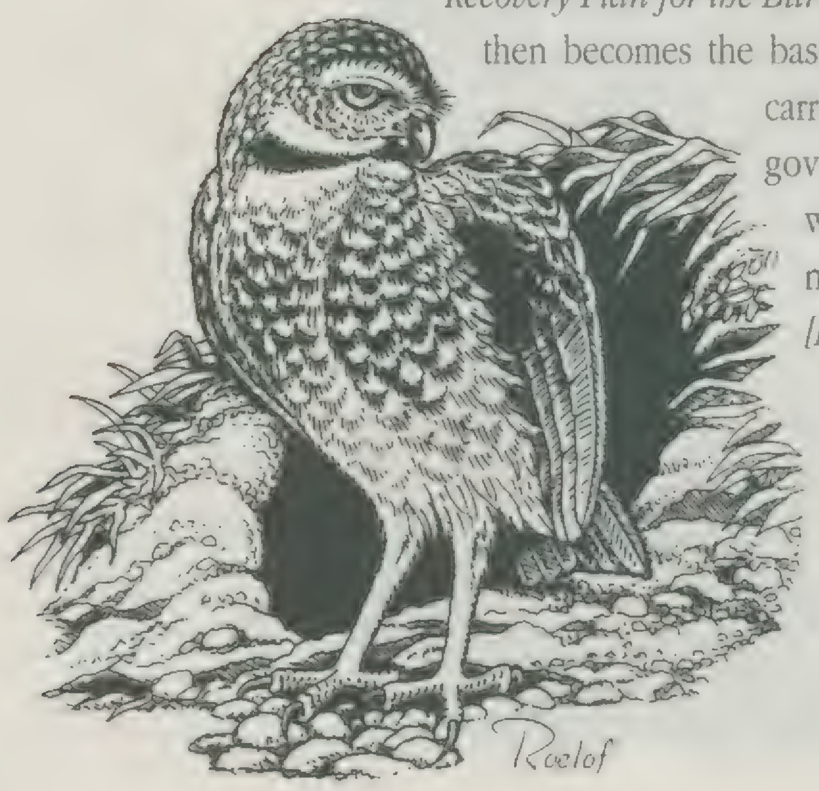
By Nick Hanley and Clive L. Spash. 1994. Ashgate Publishing Co. Brookfield, Vermont 288 pp. Paperback, ISBN 1-85278-947-6. $34.00.

This book looks at the application of cost-benefit analysis (CBA) to environmental problems ranging from wildlife protection to global warming. Structured in two parts, Part I provides an up-to-date account of the theory and practice of CBA as applied to the environment. Part II focuses on a number of specific case studies, in particular ozone damage to agricultural crops, wilderness land use, recreation, and nitrate pollution. The book summarizes the major problems CBA faces in environmental application. *[Condensed from Publisher]*

National Recovery Plan for the Burrowing Owl

By D. Hjertaas, S. Brechtel, K. De Smet, O. Dyer, E. Hang, G. Holroyd, P. James, and J. Schmutz. April 1995. Recovery of Nationally Endangered Wildlife (RENEW), Report No. 13, 33 pp. Ottawa, Ontario K1A 0H3. ISBN 0-662-20959-1.

Organized in 1988, RENEW is a strategy that brings together agencies, organizations, and interested individuals to work as a team for the recovery of wildlife at risk. RENEW focuses on those species or populations designated as extirpated, endangered, or threatened by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC). A RENEW committee, composed of the heads of government wildlife agencies and the three major national wildlife organizations, establishes a "recovery team" of experts for each species to produce a recovery plan. This recovery plan, of which the *National Recovery Plan for the Burrowing Owl* is an example, then becomes the basis for a recovery program carried out by the responsible governments in cooperation with universities, businesses, and private citizens. *[Publisher]*



Aerobiologia

International Journal of Aerobiology, Volume 11. 1995. P. Mandrioli (Editor-in-Chief), P. Comtois and F. Th. M. Spieksma (Associate Editors). Elsevier Science, Customer Service Department, P.O. Box 211, 1000 AE Amsterdam, The Netherlands. US$186.00.

Aerobiologia is the international medium for publication of original full-length research papers and review articles in the interdisciplinary fields of aerobiology (the scientific discipline focused on the transport of organisms and biologically significant materials by the atmosphere) and of biosphere/atmosphere interactions.

Volume 11 includes papers on mold biodiversity in homes; viable bacterial aerosol size distributions at an isolated high desert chaparral site; indoor air quality in schools; distribution and abundance of house dust-mites; monitoring airborne concentrations of sporangia in relation to tomato late blight; airborne grass pollen in Granada; seasonal distribution of pollen in Melborne; time linkages between pollination onsets of different taxa over 11 years in Perugia; and a historical biography on research of Charles H. Blackley. [*Overview by D.E.M.*]

Good Dirt—Confessions of a Conservationist

By David E. Morine. 1990. Ballantine Books, New York. 195 pp. Paperback, ISBN 0-345-38147-5, US$9.00, CAN$12.00.

With all the glum environmental stories in the world today, it is an agreeable change to read something that is funny and describes success stories.

David E. Morine worked for 15 years in land acquisition of the U.S. Nature Conservancy. As a briefcase wielder, his job was to persuade land owners to donate lands for conservation or donors to provide cash with which to purchase land. This involved delicate negotiations, often successful. However, sometimes things went wrong, and Morine doesn't mind telling stories on himself. By doing so, he provides human interest by describing situations and personalities, and so the book is a pleasant read. It demonstrates a practical non-confrontational approach to attaining environmental goals. And it may give some environmentalists clues about alternative methods of saving biodiversity, although a diversity of approaches is important. [*D.E.M.*]

(Continued from page 3, "Success in Jakarta")

Mr. Clifford Lincoln, Parliamentary Secretary to the Deputy Minister and Minister of the Environment, headed the Canadian delegation to Jakarta. In his remarks to delegates in the Ministerial segment of the Plenary, he addressed how the viewpoints of indigenous peoples should be incorporated at COP-3:

"It is our view that COP-3 must break new ground; that it must make a special attempt to address the issues of indigenous peoples primarily from their vantage point. The traditional approach would be for the delegations of the Parties to presume we understand the ways and needs of indigenous peoples and to speak for them from our own introverted perspectives. Mr. President, we need to hear from indigenous people directly and in unfiltered ways. Indeed some of what they have to tell us may be disturbing, but this Convention needs to listen and to take stock for its ongoing work program."

Mr. Lincoln went on to propose special indigenous panels or workshops at COP-3, preparatory workshops at the local level as well as turning over part of the usual two-day Ministerial segment to presentations by indigenous representatives. This will get COP's direct relationship with indigenous peoples off to a promising start, which we hope will generate a mutually beneficial understanding for years to come.

HARMONY IS THE KEY; CANADA'S OPPORTUNITY

After two meetings, the COP is starting to appreciate the way it must work to achieve progress with such a broad, encompassing mandate. Harmony is the key; harmony with nature, harmony among the Parties; and harmony with those others whose interests are affected by our decisions. With the Secretariat coming to Montreal and the world watching Canada more closely and placing its faith in us, the role of host takes on the added burden of exemplary performance. We are positioned to do well. The Canadian Biodiversity Strategy has just been released. We have a well-established intergovernmental and non-governmental biodiversity network to help advance the agenda, and there is a growing commitment on the part of Canadians to biodiversity values. The world has given us a challenge and an opportunity. I believe that if we pursue them seriously, our efforts will result in new and important benefits to Canadians and to our biodiversity.

For further background information on the Convention itself, COP-1 and COP-2, check out the resources found on the Canadian Biodiversity Information Network (CBIN) at **<http://www.doe.ca/ecs/biodiv/biodiv.html>** or those under the International Institute for Sustainable Development site at: **<http://www.iisd.ca/linkages/biodiv>**.

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THE LAST WORD

You can't always believe what you see. But fish can!

I had long been puzzled why so many deep-water creatures are red. This seemed ridiculous because I knew that the red part of light cannot pass through more than 10 metres of water. Indeed, most of the colours in the spectrum of white light are selectively absorbed by the water except for the green and blue parts. Therefore, is a red fish in its deep sea habitat really red? (We, of course, have all seen photos of brilliantly coloured red fish in their underwater habitat, but these photos are taken with a "white light" flash, which imports the red colour. See—you can't always believe what you see.) I was, however, determined to observe the true colour of fish in deep water with my own eyes.

Foolish me. While diving deeper than 10 m, I saw the fish almost as red as I had seen them on land in the sunlight. How could this be, given the physics of water? So, I thought, let's try recording colours on film underwater, without a flash, and compare it to what I see underwater. The film results were true to the physics of water, but very different to what I had seen: "red" fish turned distinctly brown, silvery-gray, green, or even blue, depending on the species. Wow! Why the difference?

It turned out that the human brain "corrects" colour in an object to match the standard "white light" appearance of that object—even if the light shining on it is not pure white light. For instance, we see white paper as white regardless of whether we see it in daylight, tungsten light, or fluorescent light. On the other hand, film sees the paper as white, orange or green, respectively. I was being deceived by my own eyes! I was seeing a red fish because I expected to see a red fish.

What about the fish? Experiments indicate the fish brain is like the film. Thus, a fish wouldn't see red, but browns, greys, blues, and greens. Back to the original question...why, then, are fish red? In the blue-green light of their underwater world, a green or blue fish would stand out like a light bulb, because it would reflect back all the existing light. In order to blend into the deep-sea colours, therefore, the red colour (actually a pigment on top of the fish's real colour) dulls the real colour of the fish. Because fish brains perceive colours the same way film does, they can believe what they see...even if we cannot.

Alan R. Emery, Ph.D.
President

A few words about the Canadian Museum of Nature

The origins of the Canadian Museum of Nature (CMN) were formed within the Geological Survey of Canada in 1842. Over 150 years later, the CMN has some 8 million specimens in its collection, which still represents only half the known species in this country, and an active team of scientists, collection managers, education specialists, and business experts.

The CMN's mandate is to increase knowledge and understanding of, appreciation and respect for, and interest in the natural world. This role has never been more crucial, as the demand for environmental harmony between the world's burgeoning human population and nature reaches a critical point. For more information about the Museum's activities, please contact Karen Hahn, Corporate Communications at (613) 990-6273.

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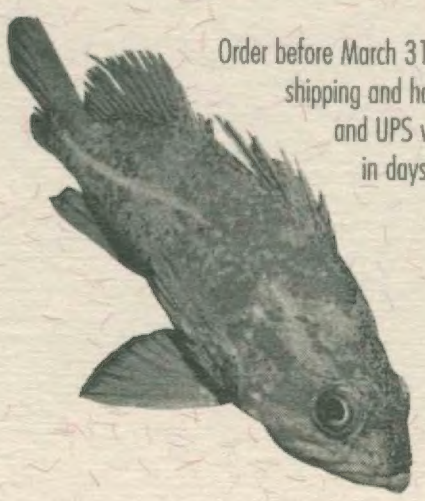

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ISSN 1195-3101 (English Edition) ISSN 1195-311X (édition française)

Cryptic Paw Lichen (*Nephroma occultum*), the first non-vascular plant to be listed as a Vulnerable species. For more detail, see page 5.

A young woman once came to me after a lecture in which I wondered at the various concepts of afterlife; the plethora of 'heavens' offered by various groups. Her view was, "This is heaven, right here. This is it. Give it all you've got."

Bill Mollison. 1988. *Permaculture*, p. 2.

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GLOBAL BIODIVERSITY Volume 5, Number 3, Winter 1995